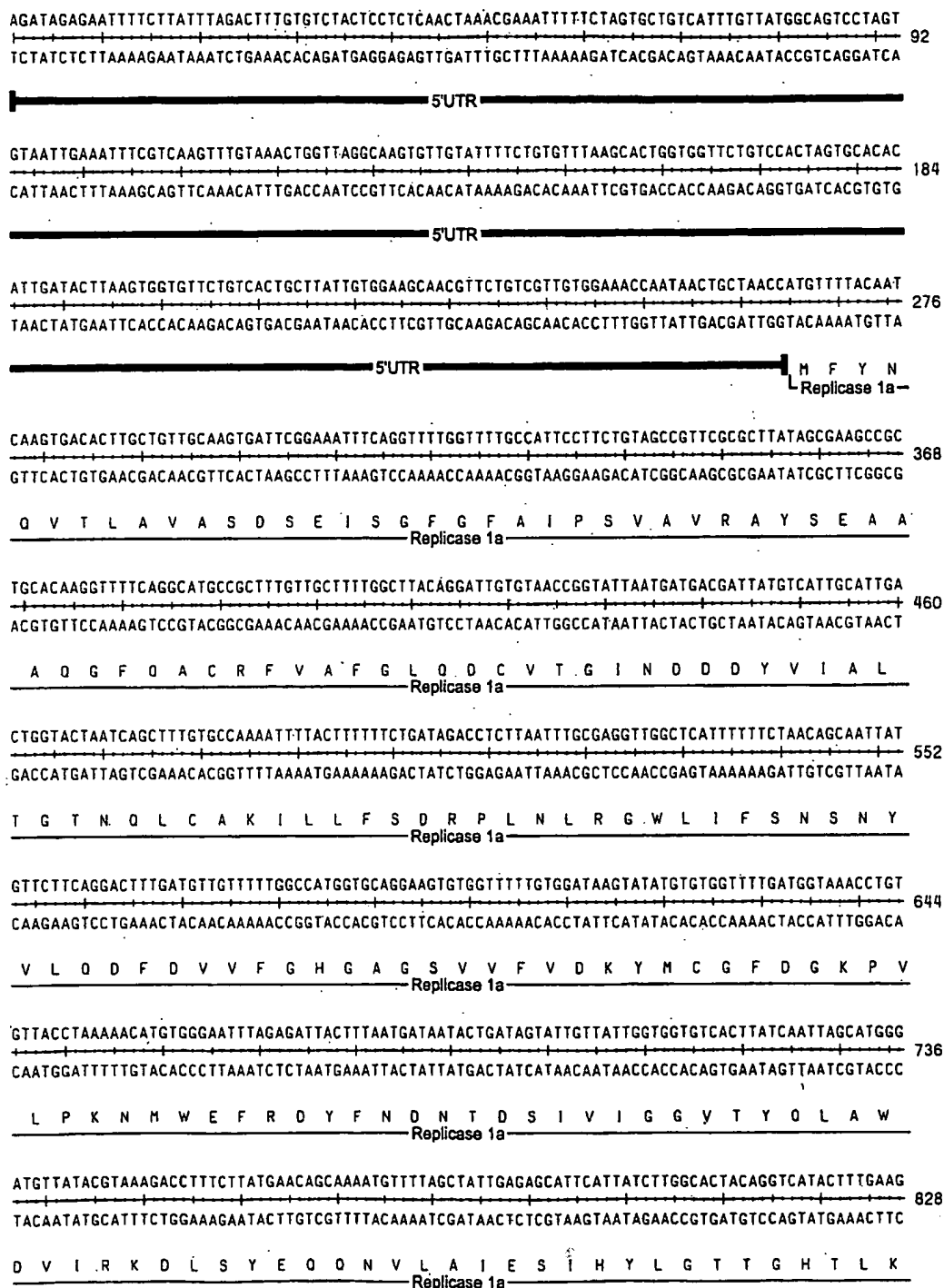


Fig. 1



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TCTGGTTGCAAACTCATTAAATGCCAAGCCGCTAAATATCTTCTAAGGTTGTTTTGAGTGGTGAATGGAATGCTGTGTATAAGGCGTTTGG
AGACCAACGTTTGAGTAATTACGGTTTCGGCGGATTTATAAGAAGATTCCAACAAAACCTACCACCTTACCTTACGACACATATTCGCAAAACC 920
S G C K L I N A K P P K Y S S K V V L S G E W N A V Y K A F G
Replicase 1a

TTCAACATTTATTACAAATGGTATATCATTGCTAGATATAATTGTTAAACAGTTTTCTTTAATGCTTTTGTAAATGCAATTGTGGTTCTG
AAGTGGTAAATAATGTTTACCATATAGTAACGATCTATATTAACAATTTGGTCAAAAGAAATTACGAAAACAATTTACGTTAACACCAAGAC 1012
S P F I T N G I S L L D I I V K P V F F N A F V K C N C G S
Replicase 1a

AGAATTGGAGTGTGGTGCATGGGATGGTATCTATCTTGTGTGGCACACCTGCTAAGAACTTTGTGTTGTTCTCGGTAATGTTGTT
TCTTAACCTCACAACCACGTACCCTACCAATAGATAGAAGAACACCGTGTGGACGATTCTTTGAAACACAACAAGGACCATTACAACA 1104
E N W S V G A W D G Y L S S C C G T P A K K L C V V P G N V V
Replicase 1a

CCTGGTGTGTGATCATCACCTCAACTGATGCTGGTGTGGTGTAAATACTATGCTGGCTTAGTTGTTAAACATATTACTAACATTACTGG
GGACCACTACACTAGTAGTGGAGTTGACTACGACCAACACCACAATTTATGATACGACCGAATCAACAATTTGTATAATGATTGAATGACC 1196
P G D V I I T S T D A G C G V K Y Y A G L V V K H I T N I T G
Replicase 1a

TGTGCTTTATGGCGTGTACAGCTGTTCTTCTGATGGAATGTTGTGGCAACATCTTCTTATGATGCACCTTTGCAAGAAATTCATTAG
ACACAGAAATACGACACAATGTCGACAAGTAAGACTACCTTACAACACCGTGTAGAGAATACTACGTGAAAACGTATCTTTAAGTAATC 1288
V S L W R V T A V H S D G M F V A T S S Y D A L L H R N S L
Replicase 1a

ACCCTTTTGCTTTGATGTTAACTTTTCTAATCAATTACGTCTAGCTTTTCTTGGTGTCTGTTACAGAAGATGTTAAATTTGCT
TGGGAAAAACGAACTACAATTTGAAATGAAAGATTAGTTAATGCAGATCGAAAAGAACCAAGACAATGTCTTCTACAATTTAAACGA 1380
D P F C F D V N T L L S N Q L R L A F L G A S V T E D V K F A
Replicase 1a

GCTAGCACTGGTGTATTGACATTAGTGGTATGTTTGGTCTTACGATGACATATTGACAAACAATAAACCTTGGTTTGTACGCAAAAGC
CGATCGTGACCACAATAACTGTAATCACGACCATACAAACGAGAAATGCTACTGTATAACTGTTTGTATTGGAACCAACATGCGTTTCG 1472
A S T G V I D I S A G M F G L Y D D I L T N N K P W F V R K A
Replicase 1a

TTCTGGGCTTTTGTGCAATCTGGGATGCTTTTGTGGCGCTATTAAGCTTGTGCCAACTACTACTGGTGGTTGGTTAGGTTTGTAAAGT
AAGACCGAAAAACTACGTTAGACCTACGAAAACAACGGCGATAATTGCAACACGGTTGATGATGACCACCAACCAATCCAACAATTCA 1564
S G L F D A I W D A F V A A I K L V P T T T G G L V R F V K
Replicase 1a

CTATCGTTCAACTGTTTTAACTGTTTCTAATGGTGTATTATTATGTGTGCGAGATGTTCCAGATGCTTTTCAACCAGTTTACCGCACATT
GATAGCGAAGTTGACAAAATTGACAAAGATTACCACAATAATAATACACAGTCTACAAGGTCTACGAAAAGTTGGTCAATGGCGTGTAAG 1656
S I A S T V L T V S N G V I I M C A D V P D A F O P V Y R T F
Replicase 1a

SUBSTITUTE SHEET (RULE 26)

TTAAAACTCTTAAGCTTACACTTACTTCTAATGGTCTTTTAGGTAATTGTGCCAAACGTTTGTAGACGTGTTTGGTAAAAATTGCTTGATGT 2576
AATTTTGGAGAATTCGAATGTGAATGAAGATTACCAGAAAATCCATTAACACGGTTTGCAAAATCTGCACAAAACATTTTAACGAACTACA
L K T L K L T L T S N G L L G N C A K R F R R V L V K L L D V
Replicase 1a

CTATAATGGTTTTCTTGAACCTGTCTGTAGTGTCTGACACTGCTGGTGTTCATTAAATATTATGCTGTTAATGTTCCATATGTAGTTA 2668
GATATTACCAAAAGAACTTTGACAGACATCACAGCATGTGTGACGACCACAAACGTAATTTATAATACGACAATTACAAGGTATACATCAAT
Y N G F L E T V C S V V H T A G V C I K Y X A V N V P Y V V
Replicase 1a

TTAGTGGTTTTGTAAGTCGTGAATTCGTAGAGAAAGGTGTGACGTGACTTTTCTTGTGTTAGTTGTGTCACTTTTTCTATGAATTTTTA 2760
AATCACCAAAACATTCAGCACATTAAGCATCTCTTTCCACACTGCCTGAAAAGGAACACAATCAACACAGTGAAAAAGATACTTAAAAAT
I S G F V S R V I R R E R C D V T F P C V S C V T F F Y E F L
Replicase 1a

GACACGTGTTTTGGTGTAGTAAACCTAATGCCATTGATGTTGAACATTTAGAGCTTAAAGAACTGTTTTGTTGAACCTAAGGATGGTGG 2852
CTGTGCACAAAACCAATCATTTGGATTACGGTAACATACTTGAATCTCGAATTTCTTTGACAAAACAACCTGGATTCCTACCACC
D T C F G V S K P N A I D V E H L E L K E T V F V E P K D G G
Replicase 1a

TCAATTTTTGTTTCTGATGATTATCTTTGGTATGTTGTAGATGACATTTATTATCCAGCTTCATGTAATGGTGTATTGCCAGTTGCTTTTA 2944
AGTTAAAAACAAGACTACTAATAGAAACCATACAACATCTACTGTAATAATAGGTCGAAGTACATTACCACATAACGGTCAACGAAAAT
O F F V S D D Y L W Y V V D D I Y Y P A S C N G V L P V A F
Replicase 1a

CAAAATGGCAGGTGGTAAAAATATCTTTTCTGATGATGTTATAGTTTCATGATGTTGAACCTACCCATAAAGTCAAGCTCATATTGAGTTT 3036
GTTTAAACCGTCCACCATTTTATAGAAAAGACTACTACAATATCAAGTACTACAACCTGGATGGGTATTTAGTTTCAGTTCAGTATAAAGTCAAA
T K L A G G K I S F S D D V I V H D V E P T H K V K L I F E F
Replicase 1a

GAAGATGATGTTGTTACCACTCTTTGTAAGAAGAGTTTTGGTAAGTCTATTATTTATACAGGTGATTGGGAAGGTTTACATGAAGTTCTTAC 3128
CTTCTACTACAACAATGGTCAGAAACATCTCTCAAACCATTCAGATAATAAATATGTCCACTAACCTTCCAAATGTACTTCAAGAATG
E D D V V T S L C K K S F G K S I I Y T G D W E G L H E V L T
Replicase 1a

ATCTGCAATGAATGTCATTGGGCAACATATTAAGTTGCCACAATTTTATATTATGATGAAGAGGGTGGTTATGATGTTTCTAAACCAAGTTA 3220
TAGACGTTACTTACAGTAACCGGTGTATAATTCAACGGTGTAAATATAAATACTACTTCTCCCACTAATACTACAAGATTGGTCAAT
S A M N V I G O H I K L P O F Y I Y D E E G G Y D V S K P V
Replicase 1a

TGATTTACAATGGCCTATTAGTGATGATAGTGATGGTTGTGTGTTGAAGCGAGCACTGATTTTCATCAATTAGAATCTGTTAGAGAAGAG 3312
ACTAAAGTGTACCGGATAATCACTACTATCACTACCAACACAACAACCTCGCTCGTGACTAAAAGTAGTTAATCTTAGACAATCTCTTCTC
M I S O W P I S D D S D G C V V E A S T O F H O L E S V R E E
Replicase 1a

GTGTGATATAATTGAACAACCTTTTGGGGAAGTTGAACATGCGCTCTCAATTAGACAACCTTTTCTTTTCTTTAGAGATGAATTGGGTGT
CAACTATATTAACCTTGTGGAAAACCCCTTCAACTTGACGCGAGAGTTAATCTGTTGGAAAAAGAAAAGAAAATCTCTACTTAACCCACA 3404

V D I I E O P F G E V E H A L S I R O P F S F S F R D E L G V
Replicase 1a

TCGTGTTTTAGATCAATCTGATAATAATTGTTGGATTAGTACCACACTTATACAGTTGCAACTTACAAAGCTTTTGGATGATTCTATTGAGA
AGCACAAAATCTAGTTAGACTATTATTAACAACCTAATCATGGTGTGAATATGTCAACGTTGAATGTTTCGAAAACCTACTAAGATAACTCT 3496

R V L D O S D N N C W I S T T L I Q L O L T K L L D D S I E
Replicase 1a

TGCAATTGTTTAAAGTTGGTAAAGTTGATTCAATTGTTCAAAGTGTATGAGTTGTCTCATTAAATTAGTGGTTCACCTGGTGATAGTGGT
ACGTTAAACAAATTCACCATTTCAACTAAGTTAACAAGTTTTCACAATACTCAACAGAGTAAATTAATCACCAGTGAACCACTATCACCA 3588

M O L F K V G K V D S I V O K C Y E L S H L I S G S L G D S G
Replicase 1a

AAACTTCTTAGTGAACCTCTTAAAGATAAATATACATGTTCTATAACTTTTGAGATGTCTTGTGATTGTGGTAAAAAGTTTGATGAGCAAGT
TTTGAAGAATCACTTGAAGAATTTCTATTATATGTACAAGATATTGAAAACCTACAGAACACTAACACCATTTTCAAACACTCTCGTTCA 3680

K L L S E L L K D K Y T C S I T F E M S C D C G K K F D E O V
Replicase 1a

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ACCAACAACAAAACCTAATACGGAATGTGTTTGAAGAAGTTTTCACCTACACATAAACAGTATTTACGCTGAATATTGGAACAAT 3772

G C L F W I M P Y T K L F O K G E C C I C H K M O T Y K L V
Replicase 1a

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CATACTTTCCATGACCACACAAACATGCTAGGTCGTGGATAACTGTAACACGAAAGGACAACTCGGATATACAAGTAGACATATAAAT 3864

S M K G T G V F V O D P A P I D I D A F P V R P I C S S V Y L
Replicase 1a

GGTGTAAAGGTCTGGTCAATTATCAACAAATTTATACAGTTTGCACAAAGCTATTGATGGTTTTGGTGTCTTTGACATTAAAAATAGTAG
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G V K G S G H Y Q T N L Y S F D K A I D G F G V F D I K N S S
Replicase 1a

TGTTAATACTGTTTGTGTTGTTGATGTTGATTTTCATAGTGTAGAAATAGAAGCTGGTGAAGTTAAACCTTTTGTCTATATAAAATGTTA
ACAATTATGACAAACAAAACACTACAATAAAAGTATCATCTTTATCTTCGACCACTTCAATTTGGAACGACATATATTTTACAAT 4048

V N T V C F V D V D F H S V E I E A G E V K P F A V Y K N V
Replicase 1a

AATTTTATTAGGTGATATTTACACCTTGTAACCTGTGTTCTTTTGACITTTGTTGTAATGCTGCTAATGAAAATCTCATGCATGGAGGC
TTAAAAATAATCCACTATAAAGTGTGAACATTTGACACAAGAAAACCTGAAACAACAGTTACGACGATTACTTTAGAGTACGTACCTCCG 4140

K F Y L G D I S H L V N C V S F D F V V N A A N E N L M H G G
Replicase 1a

GGTGTGCGACGTGCTATTGATATTTGACTGAAGGTCAACTTCAGTCATTATCTAAAGATTACATTAGTAGTAATGGTCCACTTAAGGTTGG 4232
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G V A R A I D I L T E G O L Q S L S K D Y I S S N G P L K V G
Replicase 1a

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TCGTCCACAATACAACCTCACACTTTTTAAGTTACATAAATTACAACAACCGGCGCTTGACCAATTGTAAGTAAAGTAATGAACAACCTTC
A G V M L E C E K F N V F N V V G P R T G K H E H S L L V E
Replicase 1a

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GAATATTAAGATAAAATAAATTTTACCATAAGGTGAATACGGAGAAGAATCAACACCATAAAACCACATTCCTAACCTTTTAAGAGAATTT
A Y N S I L F E N G I P L M P L L S C G I F G V R I E N S L K
Replicase 1a

GCTTTGTTAGTTGTGACATTAATAAACCATTCGAAGTTTTGTTTATCTTCAAATGAAGAACAAGCTGTTCTTAAGTTTTAGATGGTTT 4508
CGAAACAAATCAACACTGTAATTATTTGGTAACGTTCAAAACAATAAGAAGTTTACTTCTGTTGACAGAAGTCAAAATCTACCAAA
A L F S C D I N K P L Q V F V Y S S N E E Q A V L K F L D G L
Replicase 1a

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TCTAAATGTGGTCAGTAACGCTACAACACTACAACAATTTGAAATCTCAACTTCCATTAAGTAAGAACTAACACCACAGTTACGGA
D L T P V I D D V D V V K P F R V E G N F S F F D C G V N A
Replicase 1a

TGGATGGTGATATTACTTATTATTTACTAECTATTTTAAATGTTGGATAAACAAGGACAATTATTGGACACAAAATTAATGGTATTTTG 4692
ACCTACCCTATAAATGAATAAATAATGATTGAGATAAAATTACAACCTATTTGTTCTGTTAATAACCTGTGTTTGAATTACCATAAAAC
L D G D I Y L L F T N S I L M L D K O G O L L D T K L N G I L
Replicase 1a

CAACAGGCAGTTCTTGATTATCTTGCTACAGTTAAACTGTACCAGCTGGTAATTTGGTTAACTTGTGTTGAGAGTTGTACCATTATAT 4784
GTTGTCGTCAGAACTAATAGAACGATGCAATTTGACATGGTCGACCATTAAACCAATTGAACAACAACCTCAACATGTTAAATATA
Q Q A V L D Y L A T V K T V P A G N L V K L V V E S C T I Y M
Replicase 1a

GTGTGTTGTACCATCGATAAATGATCTTTCTTTGATAAAATCTTGGTCGTTGTGCGTAACTTAATAGATTGAAAACCTTGTTATTG 4876
CACACAACATGGTAGCTATTTACTAGAAGAAAATCTTTTAGAACCGCAACACACGCAATTTGAATTATCTAACTTTTGAACACAATAAC
C V V P S I N D L S F D K N L G R C V R K L N R L K T C V I
Replicase 1a

CCAATGTTCTGCTATTGATGTTTTGAAAAAGCTTCTTCAAGTTGACTTTAACTGTTAAATTTGTTGAGAGTAATGTTATGGATGTT 4968
GGTTACAAGGACGATAACTACAAAATCTTTGGAAGAAAGTTCAAAGTGAATTTGACAATTTAAACAACATCTCTATTACAATACCTACAA
A N V P A I D V L K K L L S S L T L T V K F V V E S N V M D V
Replicase 1a

AACGACTGTTTTAAGATGATAATGTAGTTTTGAAAATTACTGAAGATGGTATTAAATGTTAAAGATGTTGTTGTTGAGTCTTCTAAGTCACT 5080
TTGCTGACAAAATCTTACTATTACATCAAACTTTTAATGACTTCTACCATAATTACAATTTCTACAACAACAACCTCAGAAGATTCAGTGA
N D C F K N D N V V L K I T E D G I N V K D V V V E S S K S L
Replicase 1a

TGGTAAACAATTGGGTGTTGTGAGTGATGGTGTGACTCTTTTGAAGGTGTTTTACCTATTAATACTGATACTGTCTTATCTGTAGTCCAG 5152
ACCATTTGTTAACCACAACACTCACTACCACAACCTGAGAAAACCTCCACAAAATGGATAATTATGACTATGACAGAATAGACATCGAGGTC
G K O L G V V S D G V D S F E G V L P I N T D T V L S V A P
Replicase 1a

AAGTTGACTGGGTGCTTTTTACGGTTTTGAAAAGGCAGCACTTTTTGCTTCTTTGGATGTAAAGCCATATGGTTACCTAATGATTTTGT 5244
TTCAACTGACCCACGAAAATGCCAAAACCTTTCCGTCGTGAAAAACGAGAAACCTACATTTCCGTATACCAATGGGATTACTAAAACAA
E V D W V A F Y G F E K A A L F A S L D V K P Y G Y P N D F V
Replicase 1a

GGTGGTTTTAGAGTCTTGGGACCCGACAATAATTGTTGGGTAAATGCAACTTGATAATTTTACAGTATCTTAAGCCTACTTTTAAATC 5336
CCACCAAAATCTCAAGAACCCTGGTGGCTGTTATTAACAACCAATTACGTTGAACATATTAAAATGTCATAGAATCGGATGAAAATTTAG
G G F R V L G T T D N N C W V N A T C I I L Q Y L K P T F K S
Replicase 1a

TAAGGGTTTAAATGTTCTTTGGAACAAATTTGTTACAGGTGATGTTGGACCTTTTGTAGTTTTATTATTTTATAACTATGCTTCAAAGG 5428
ATCCCAAAATTTACAAGAACCTTGTTTAAACAATGTCCACTACAACCTGGAAAACAATCAAAATAAATAAAATATTGATACAGAAGTTTCC
K G L N V L W N K F V T G D V G P F V S F I Y F I T M S S K
Replicase 1a

GTCAAAGGGTGATGCTGAAGAGGCATTATCTAAATTGTCAGAGTATTTGATTAGTGATTCTATTGTTACTCTTGAACAATATTCAACTGT 5520
CAGTTTTCCCACTACGACTTCTCCGTAATAGATTTAACAGTCTCATAAACTAATCACTAAGATAACAATGAGAACTGTTATAAGTTGAACA
G O K G D A E E A L S K L S E Y L I S D S I V T L E Q Y S T C
Replicase 1a

GACATTTGTAAGTACTGTAGTTGAAGTTAAAGTGCTGTTGTCTGTGCTAGTGTGCTTAAAGATGGTTGTGATGTTGGTTTTGTCCACA 5612
CTGTAACATTTTCATGACATCAACTTCAATTTTCACGACAACAGACACGATCACACGAATTTCTACCAACACTACAACCAAAAACAGGTGT
D I C K S T V V E V K S A V V C A S V L K D G C D V G F C P H
Replicase 1a

CAGACATAAATTGCGTTCACGTGTTAAGTTTGTAAATGGACGTGTTGTTATTACCAATGTTGGTGAACCTATAATTCACAACCTTCTAAGT 5704
GTCTGATTTAACGCAAGTGACAATTCAACAATTACCTGCACAACAATAATGGTTACAACCACTTGGATATTAAAGTGTGGAAGATTCA
R H K L R S R V K F V N G R V V I T N V G E P I I S O P S K
Replicase 1a

TGCTTAATGGTATTGCTTATACAACATTTTCAGGTCTTTTGATAACGGTCACTATGTAGTTTATGATGCTGCTAATAATGCTGTCTATGAT 5796
ACGAATTACCATAACGAATATGTTGTAAGTCCAAGAAAACCTATTGCCAGTGATACATCAAACTACGACGATTATTACGACAGATACTA
L L N G I A Y T T F S G S F O N G H Y V V Y D A A N N A V Y D
Replicase 1a

GGTGCTCGTTTATTTGCTTCAGATTTGTCTACTTTAGCTGTTACAGCTATTGTTGTAGTAGGTGGTTGTGAACATCTAATGTTCCACCAAT 5888
CCACGAGCAAATAAACGAAGTCTAAACAGATGAAATCGACAATGTCGATAACAACATCATCCACCAACACATTGTAGATTACAAGGTGGTTA
G A R L F A S D L S T L A V T A I V V V G G C V T S N V P P I
Replicase 1a

TGTTAGTGAGAAAATTTCTGTTATGGATAAACTTGATACTGGTGCACAAAAATTTTCCAATTTGGTGATTTTGTATGAATAACATTGTTC 5980
ACATCACTCTTTTAAAGACAATACCTATTTGAACATGACCACGTGTTTTTAAAAAGGTTAAACCACTAAAAACAATCTTATTGTAACAAG
V S E K I S V M D K L D T G A O K F F O F G D F V H N N I V
Replicase 1a

TGTTTTTAACCTGGTGCTTAGTATGTTTAGTCTTTACGTACTTCTATTATGAAGCATGATATTAAAGTTATTGCCAAGGCTCCATAACGT 6072
ACAAAAATGAACCAACGAATCATACAAATCAGAAAATGCATGAAGATAATACITTCGTACTATAATTTCAATAACGGTTCGAGGATTGCA
L F L T W L L S H F S L L R T S I H K H D I K V I A K A P K R
Replicase 1a

ACAGGTGTTATTTTGACACGTAGTTTTAAGTATAACATTAGATCTGCTTTGTTTGTGTAAGCAGAAGTGGTGTGTTATTGTTACTTTGTT 6164
TGCCACAATAAACTGTGCATCAAAATTCATATTGTAATCTAGACGAACAAACAACATTCGTCTTCACCACACAATAACAATGAACAA
T G V I L T R S F K Y N I R S A L F V V K O K W C V I V T L F
Replicase 1a

TAAGTCTTATTGTTATTATATGCTATTTATGCACTTGTTTTATGATTGTGCAATTTAGTCTTTTAAAGTCTTTTATGTTGGTGACATTG 6256
ATTCAAGAATAACAATAATATACGATAAATACGTGAACAAAAATACTAACACGTTAAATCAGGAAAATTATCAGAAAATACACCACTGTAAC
K F L L L L Y A I Y A L V F H I V O F S P F N S L L C G D I
Replicase 1a

TAAGTGGTTATGAAAAATCCACTTTTAAATAAGGATATTTATTGGTAAATCTATGGTTTGTAAAGATGTGTTTGTATTAGTTATCAAGAGTTT 6348
ATTCAACAATACTTTTATGGTGAATTTATCTATAAATAACACCATTAAGATACCAAAACATTCTACACAAACAATCAATAGTTCTCAAA
V S G Y E K S T F N K O I Y C G N S H V C K M C L F S Y O E F
Replicase 1a

AATGATTGGATCATACTAGTCTTTGTTTGAAGCACATTCGTGATCCTATATTAATCAGTTTACAAACATTTGTTATCTTGTATTTTGT 6440
TTACTAAACCTAGTATGATCAGAACAACCTTCGTGAAGCACTAGGATATAATTAGTCAAAATGTTGGTAAACAATATGAACAATAAAACAA
N D L D H T S L V W K H I R D P I L I S L O P F V I L V I L L
Replicase 1a

AATTTTGGTAAATATGTTTTCGCTTTTGGACTTTTATATTTGTTGCACAAATTTATAGTACTTTTGGTCTTTCTTAGGCTTTTCATCAGA 6532
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I F G N M Y L R F G L L Y F V A O F I S T F G S F L G F H O
Replicase 1a

AACAGTGGTTTTACATTTTGTGCCGTTTGATGTTTTATGTAATGAGTTTTAGTACATTTATTGCTGCAAAATGTTTTATTGTTAGA 6624
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K O W F L H F V P F D V L C N E F L A T F I V C K I V L F V R
Replicase 1a

CATATTATTGTTGGCTGTAATAATGCTGACTGTGTAGCTTGTCTAAAGTGCTAGACTTAAACGTGTACCACTTCAAACATTATTATTAATGG 6716
GTATAATAACAACCGACATTATTACGACTGACACATCGAACAAGATTTTCAGATCTGAATTTGCACATGGTGAAGTTTGATAATAATTACC
H I I V G C N N A D C V A C S K S A R L K R V P L Q T I I N G
Replicase 1a

TATGCATAAATCATTCTATGTTAATGCTAATGGTGGTACTTGTCTGTAATAAACATAACTTCTTTTGTTAATTGTGATTCCTTTGGGC 6808
ATACGTATTAGTAAGATACAATTACGATTACCACCATGAACAAAGACATTATTGTATTGAAGAAAACACAATTAACACTAAGAAAACCCG
H H K S F Y V N A N G G T C F C N K H N F F C V N C D S F G
Replicase 1a

CTGGTAATACTTTTATTAATGGTGATTTGCAAGAGAGCTTGGTAATGTTGTTAAACAGCTGTTCAACCCACAGCTCCTGCATATGTTATT 6900
GACCATTATGAAAATAATTACCATAAAGCTTCTCTCGAACCATTACAACAATTTTGTGACAAGTTGGGTGTCGAGGACGTATACAATAA
P G N T F I N G D I A R E L G N V V K T A V Q P T A P A Y V I
Replicase 1a

ATTGATAAGGTAGATTTTGTAAATGGATTTTATCGTCTTTATAGTGGTGACACTTTTGGCGGTATGACTTTGACATTACTGAATCTAAGTA 6992
TAACTATTCCATCTAAACAATTACCTAAAATAGCAGAAATATCACCAGTGTGAAAAACGCCATCTGAAACTGTAATGACTTAGATTCAT
I D K V D F V N G F Y R L Y S G D T F W R Y D F D I T E S K Y
Replicase 1a

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ATCAACATTTCTCAAGACTTCTTAAACATTACAAAATCTTTTAAAAATAACAATGTTATTATCACCATCATTGTAATGTGTCTAATTTTAC
S C K E V L K N C N V L E N F I V Y N N S G S N I T Q I K N
Replicase 1a

CTTGTGTTTATTTTCTCAATTGTTGTGTGAACCTATAAAGTTGGTAAATTCAGAGTTGTTGTCAACTTTATCAGTTGATTTTAATGGTGT 7176
GAACACAAATAAAAAGAGTTAAACACACACTTGGATATTTCAACCATTTAAGTCTCAACAACAGTTGAAATAGTCAACTAAAATTACCACAA
A C V Y F S O L L C E P I K L V N S E L L S T L S V D F N G V
Replicase 1a

TTGCATAAGGCATATGTTGATGTTTTGTGTAATAGTTTTTAAAGGAGCTAACTGCTAACATGTCCATGGCTGAATGTAAGCTACACTTGG 7268
AACGTATTCGGTATACAACACAAACACATTATCAAAAAATTCCTCGATTGACGATTGTACAGGTACCGACTTACATTCGATGTGAACC
L H K A Y V D V L C N S F F K E L T A N M S M A E C K A T L G
Replicase 1a

TTGACTGTTTCTGATGATGATTTTGTTCAGCTGTTGCCAATGCACATAGGTATGACGTTTGTCTTCAGATTTGTCATTTAATAATTTT 7360
AAACTGACAAAGACTACTACTAAAACAAAGTCGACAACGGTTACGTGTATCCATACTGCAAAACGAAAGTCTAAACAGTAAATTATTAATAA
L T V S O D D F V S A V A N A H R Y D V L L S O L S F N N F
Replicase 1a

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AATAAGAATACGATTGGACTTCTATTCAACAGGCAAACTGTAAACGAACAACATACGACGCGCAAGATTCCAACAATTGGTATTACAA
F I S Y A K P E D K L S V Y D I A C C M R A G S K V V N H N V
Replicase 1a

TTAATCAAAGAGTCAATACCTATTGTTTGGGGTGCAAGGACTTTAATACTCTTTCTCAAGAAGSTAAGAAGTACCTTGTTAAACAACATAA
AATTAGTTTCTCAGTTATGGATAACAAACCCACAGTTCCTGAAATTATGAGAAAGAGTTCTTCCATTCTTCATGGAACAATTTGTGATT 7544
L I K E S I P I V W G V K D F N T L S O E G K K Y L V K T T K
Replicase 1a

AGCAAAGGGTTTGACTTTTTTATTAACTTTTAATGATAACCAAGCAATTACACAAGTTCCTGCTACTAGTATAGTTGCAAACAGGGTGCTG
TCGTTTCCAAACTGAAAAATAATTGAAATTACTATTGGTTCGTTAATGTGTTCAAGGACGATGATCATATCAACGTTTGTCCACGAC 7636
A K G L T F L L T F N D N Q A I T O V P A T S I V A K Q G A
Replicase 1a

GTTTTAAACGTACTTATAATTTCTGTGGTATGTATGTTTATTTGTTGTCATTGTTTATTGGTGTCTCATTTATTGATTATACAACCACT
CAAAATTTGCATGAATATTAAGACACCATACATAAAATAACAACAGTAACAATAAACCACAGAGTAAATACTAATATGTTGGTGA 7728
G F K R T Y N F L W Y V C L F V V A L F I G V S F I D Y T T T
Replicase 1a

GTAAGTAGCTTTCATGGTTATGATTTTAAGTACATTGAGAATGGTCAGTTGAAGGTGTTGAAGCACCTTTACACTGTGTTGTAATGTTTT
CATTGATCGAAAGTACCAATACTAAATTCATGTAACCTTACCAGTCAACTTCCACAACTTCGTGGAATGTGACACAAGCATTACAAAA 7820
V T S F H G Y D F K Y I E N G O L K V F E A P L H C V R N V F
Replicase 1a

TGATAATTTAATCAATGGCATGAGGCTAAGTTTGGTGTGTTACTACTAATAGTGATAAATGTCCTATAGTTGTTGGTGTTCAGAGCGTA
ACTATTAATAATTAGTTACCGTACTCCGATTCAAACCAACAATGATGATTATCACTATTTACAGGATATCAACAACCAACAAGTCTCGCAT 7912
D N F N O W H E A K F G V V T T N S D K C P I V V G V S E R
Replicase 1a

TTAATGTTGTTCTGGTGTTCACAAATGTATATTTGGTAGGAAAGACTCTTGTGTTTACATTACAGGCTGCTTTTGGAAACACAGGTGT
AATTACAACAAGGACCAAGGTGTGTTACATATAAACCATCTTTCTGAGAACAAAATGTAATGTCGACGAAAACCTTTGTGTCACAA 8004
I N V V P G V P T N V Y L V G K T L V F T L O A A F G N T G V
Replicase 1a

TGTTATGACTTTGATGGTGTACCACTAGTGATAAGTGATTTTTAATCTGCTTGCTAGGTTGGAAGGTTTGGGTGGTGACAAATGTTTA
ACAATACTGAAACTACCACAATGGTGATCACTATTCACATAAAATTAAGACGAACATGATCCAACCTTCCAACCCACCACTGTTACAAAT 8096
C Y D F D G V T T S D K C I F N S A C T R L E G L G G D N V Y
Replicase 1a

TGTTACAACACTGATCTTATTGAAGGTCTAAACCTTATAGTATTTTACAGCCCAATGCTTATTATAAGTATGATGTTAAAAATTATGTAC
ACAATGTTGTGACTAGAATACTTCCAAGATTGGAATATCATAAAATGTCGGGTACGAATAATATTCATACTACAATTTTAAATACATG 8188
C Y N T D L I E G S K P Y S I L O P N A Y Y K Y D V K N Y V
Replicase 1a

GTTTCCAGAAATTTAGCTAGAGGTTTGGCTTACGTACTATTAGAACCTTTGGCTACACGTTATTGTAGAGTTGGTGAATGCCGTGACTCA
CAAAAGGTCTTTAAATCGATCTCCAAACCGAATGCATGATAATCTTGAACCGATGTGCAATAACATCTCAACCCTTACGGCACTGAGT 8280
R F P E I L A R G F G L R T I R T L A T R Y C R V G E C R D S
Replicase 1a

CATAAAGGTGTTTGGTTTGGTAAATGGTATGTTAATGATGGACGTGTTGATGACGGTTACATTTGTGGTATGGTCTTATAGACCT 8372
GTATTTCCACAAACAAACCAAACTATTACCATACAATTACTACCTGCACAACACTGCGCAATGTAAACACCACTACCAGAAATATCTGGA
H K G V C F G F D K W Y V N D G R V D D G Y I C G D G L I D L
Replicase 1a

TCITGTTAATGACTCTCAATCTTTAGTTCATCTTTAGCGTTGTGGCTATGCTGGACATATGTTGTTTAAATTTCTTTTGCAGCATTTA 8464
AGAACAATTACATGAGAGTTAGAAATCAAGTAGAAATCGCAACACCGATACGACCTGTATACAACAAATTTAAAGAAAAACGTCGTAAT
L V N V L S I F S S S F S V V A M S G H M L F N F L F A A F
Replicase 1a

TTACATTTTGTGCTTTTGTACTAAATTTAAACGTGTTTTGGTGATCTTCTTATGGTGTGTTTACTGTGTTGTGCAACTTTGATT 8556
AATGTAAAACACGAAAAATCAATGATTTAAATTTGCACAAAACCACTAGAAAGAATACCACAAAATGACAACAAACACGTTGAAACTAA
I T F L C F L V T K F K R V F G D L S Y G V F T V V C A T L I
Replicase 1a

AATAACATTTCTTATGTTGTACTCAAAATTTATTTTTATGTTGCTTTATGCTATTTGTATTTGTTTTACTAGGACAGTGGCTTATGC 8648
TTATGTAAAGAATACAACATGAGTTTAAATAAAAAATACAACGAAATACGATAAAACATAAAACAAAATGATCCTGTACGCAATACG
N N I S Y V V T O N L F F M L L Y A I L Y F V F T R T V R Y A
Replicase 1a

TTGGATTTGGCATATTGCATACATTTGTCATACTTCTTGTTAATACCATGGTGGCTTCTCATGTTTGTGTTTGTGTCATTTTGTAGGC 8740
AACCTAAACCGTATAACGTATGTAACAACGTATGAAGAACAATTATGTTACACCGAAGAGTGTACCAATCAAACGACGTAAAAATCTCG
W I W H I A Y I V A Y F L L I P W W L L T W F S F A A F L E
Replicase 1a

TTTACCTAATGTTTTAAGTTAAAACTCTACTCAATTGTTGAAGGTGATAAGTTTATAGGTACTTTGAGAGTGCTGCTGCAGGTACA 8832
AAAATGGATTACAAAATTCATTTTGTAGATGAGTTAACAACCTCCACTATTCAAATATCCATGAAAACCTCTCAGCAGCAGTCCATGT
L L P N V F K L K I S T O L F E G D K F I G T F E S A A A G T
Replicase 1a

TTTGTCTTGACATGCGTTCTTATGAAAGGCTGATAAATCTATTTACCTGAGAACTTAAGAATTATGCTGCAAGTTATAATAATATAA 8924
AAACAAGAACTGTACGCAAGAATACTTTCCGACTATTTATGATAAAGTGGACTCTTTGAATCTTAATACGACGTTCAATATTATTATTT
F V L D M R S Y E R L I N T I S P E K L K N Y A A S Y N K Y K
Replicase 1a

ATATTATAGTGGTAGTGCTAGTGAGGCTGATTATCGTTGTGCTTGTATGCTCATTAGCCAAGGCTATGTTAGATTACGCAAAAGATCATA 9016
TATAATATCACCATCAGGATCACTCCGACTAATAGCAACACGAACATACGAGTAAATCGGTTCCGATACAATCTAATGCGTTTCTAGTAT
Y Y S G S A S E A D Y R C A C Y A H L A K A M L D Y A K D H
Replicase 1a

ATGACATGTTATATTCTCCACCTACCATTAGCTACAATTCACCTTACAATCTGGTCTTAAGAAGATGGCACAACCATCTGGTTGTGTTGAG 9108
TACTGTACAATATAAGAGGTGGATGGAATCGATGTTAAGGTGGAATGTTAGACCAGAATCTTCTACCGTGTGGTAGACCAACACAACCTC
N D M L Y S P P T I S Y N S T L O S G L K K M A O P S G C V E
Replicase 1a

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AGATGTGTGGTTCGGCTCTGTTATGGTAGTACTGTGCTTAATGGAGTTTGGTTAGGTGACACTGTTACTTGTCTAGACATGTCATAGCACC 9200
TCTACACCAAGCGCAGACAATACCATCATGACACGAATTACCTCAAACCAATCCACTGTGACAATGAACAGGATCTGTACAGTATCGTGG
R C V V R V C Y G S T V L N G V W L G D T V T C P R H V I A P
Replicase 1a

ATCAACCACTGTTCTTATTGATTATGATCATGCATATAGTACTATGCGTTTGCATAATTTTTCAGTGTCTCATAATGGTGTCTTCTGGGAG 9292
TAGTTGGTGACAAGAATAACTAATACTAGTACGTATATCATGATACGCAACGTATTAAGAGTCACAGAGTATTACCACAGAAGAACCCTC
S T T V L I D Y D H A Y S T H R L H N F S V S H N G V F L G
Replicase 1a

TTGTTGGTGTACAATGCATGGTCTGTGTTGCGTATTAAGGTTTCAACATCTAATGTACATACACCTAAACATGTTTTTAAACGTTGAAA 9384
AACCAACCAATGTTACGTACCAAGACACAACGCATAATCCAAAGTGTAGATTACATGTATGTGGATTGTACAAAAATTTGCAACTTT
V V G V T H H G S V L R I K V S O S N V H T P K H V F K T L K
Replicase 1a

CCTGGTGCTTCTTTAATATTTAGCATGTTATGAAGTATTGCATCTGGTGTGTTTTGGTGTAAATTTACGTACAAACTTTACTATTAAAGG 9476
GGACCAGAAGAAAATTATAAATCGTACAATCTCCATAACGTAGACCACAAAACCACAATTAATGCATGTTGAAATGATAATTCC
P G A S F N I L A C Y E G I A S G V F G V N L R T N F T I K G
Replicase 1a

TTCTTTTATAAATGGAGCTTGTGGTCTCCTGGTTATAATGTTAGAAATGATGGTACTGTTGAGTTTTGTTATTTACACCAAATTGAGTTAG 9568
AAGAAAATATTACCTCGAACCAAGAGGACCAATATTACAATCTTTACTACCATGACAACCTCAAAACAATAAATGTGGTTAACTCAATC
S F I N G A C G S P G Y N V R N D G T V E F C Y L H O I E L
Replicase 1a

GTAGTGGTGCTCATGTTGGTCTGATTTTACTGGTAGTGTATGGAATTTTGATGACCAACCTAGTTTGCAAGTTGAGAGTGCCAACTT 9660
CATCACCACGAGTACAACCAAGACTAAAATGACCATCACAATACCAATTAACCACTGTTGGTGGATCAACGTTCAACTCTCAGGTTGGAA
G S G A H V G S D F T G S V Y G N F D D O P S L O V E S A N L
Replicase 1a

ATGCTATCAGATAATGTTGTTGCTTTTGTATGCTGCTTTGTTGAATGGTGTAGGTGGTGGTTCAGTCAACTAGAGTTAATGTTGATGG 9752
TACGATAGTCTATTACAACACGGAACATACGACGAAACCACTTACCAACATCCACCACCAACGCAAGTTGATCTCAATTACAACCTAC
M L S D N V V A F L Y A A L L N G C R W W L R S T R V N V D G
Replicase 1a

TTTTAATGAATGGGCTATGGCTAATGGTTATACAATTGTTTCTAGTGTGAGTGCTATTCTATTTTGGCAGCAAAAACCTGGTGTAGTGTG 9844
AAAATTACTTACCCGATACCGATTACCAATATGTTAACAAGATCACAACCTCAGATAAGATAAAACCGTCGTTTTTGACCACAATCACAAC
F N E W A M A N G Y T I V S S V E C Y S I L A A K T G V S V
Replicase 1a

AACAATTGTTAGCTTCCATTCAACATCTTCATGAAGGTTTTGGTGGTAAAAACATACTTGGTTATTCTAGTTTATGTGATGAGTTCACACTA 9936
TTGTTAACAATCGAAGGTAAGTTGTAGAAGTACTTCCAAAACCACTTTTGTATGAACCAATAAGATCAAATACACTACTCAAGTGTGAT
E O L L A S I O H L H E G F G G K N I L G Y S S L C D E F T L
Replicase 1a

GCTGAAGTTGTGAAGCAGATGTATGGTGAACCTGCAAAGTGGTAAGGTTATTTTGGTTTAAAAACAATGTTTTATTTAGCGTTTTCTT 10028
CGACTTCAACACCTTCGTCTACATACCACAATTGAACGTTTCACCATTCCAATAAAAACCAAATTTTGTACAAAATAAATCGCAAAAGAA
A E V V K Q M Y G V N L O S G K V I F G L K T M F L F S V F F
Replicase 1a

CACAAATGTTTTGGGCAGAATCTTTATTTATACAAACTATATGGATAAACCTGTTATACTTACACCTATATTTTGTITACTTTTGTITTT 10120
GTGTTACAAAACCGCTCTTGAGAAATAAATATGTTTGTGATATACCTATTTGGGACAATATGAATGTGGATATAAAACAAATGAAAACAAA
T M F W A E L F I Y T N T I W I N P V I L T P I F C L L L F
Replicase 1a

TGTCATTAGTTTTAACTATGTTTCTTAAACATAAGTTTTGTTTTGCAAGTATTTTATTACCTACTGTTATTGCAACTGCTTTATATAAT 10122
ACAGTAATCAAAATGATACAAAGAATTGTATTCAAAAACAAAACGTTCAATAAATAATGGATGACAATAACGTTGACGAAATATATTA
L S L V L T M F L K H K F L F L O V F L L P T V I A T A L Y N
Replicase 1a

TGTGTTTTGGATTATTACATAGTAAATTTTTGGCTGACCATTTTAACTATAATGTTTCAGTATTACAAATGGATGTTTCAGGGTTTAGTTAA 10304
ACACAAAACCTAATAATGTATCATTTTAAAAACCGACTGGTAAATGTATATTACAAAGTCATAATGTTTACCTACAAGTCCCAAATCAATT
C V L D Y Y I V K F L A D H F N Y N V S V L Q M D V Q G L V N
Replicase 1a

TGTTTTGGTCTGTTATTTGTTGTTATTTTACACACATGGCGTTTTCTAAGAACGTTTCACACATTGGTTTACATATGTGTGTTCTCTTA 10396
ACAAAACGAGACAAATAAACACATAAAATGTGTGACCGCAAAAAGATTCTTGCAAAGTGTGAACCAAATGTATACACACAAGAGAAT
V L V C L F V V F L H T W R F S K E R F T H W F T Y V C S L
Replicase 1a

TAGCAGTTGCTTACACTATTTTATAGTGGTGACTTTTGAAGTTTGGTTGTTATGTTTTATGTGCTATATCTAGTGATTGGTACATTGGT 10488
ATCGTCAACGAATGTGAATAAAATATCACCCTGAAAACTCAAACGAACAATACAAAATACACGATATAGTACTAACCATGTAACCA
I A V A Y T Y F Y S G D F L S L L V M F L C A I S S D W Y I G
Replicase 1a

GCCATTGTTTTAGGTTGTCACGTTTGATTATATTTTTTACCTGAAAGTGATTTAGTGTTTTTGGTGATGTGAACTCACTTTAGTTGT 10580
CGGTAACAAAATCCAACAGTGCAAACTAATAAAAAAGTGGACTTTCACATAAATCACAAAACCACTACCTTTGAGTGAAATCAACA
A I V F R L S R L I I F F S P E S V F S V F G D V K L T L V V
Replicase 1a

TTATTTAATTTGTGGTTATTTAGTTTGTACTTATTTGGGCAATTTGATTGGTTCAATAGGTTTTTAAATGTACTATGGGTGTTTATGATT 10672
AATAAATTAACACCAATAAATCAACATGAATAACCCGTAACATAACCAAGTTATCCAAAAATTTACATGATACCCACAATACTAA
Y L I C G Y L V C T Y W G I L Y W F N R F F K C T M G V Y D
Replicase 1a

TTAAGGTGAGTGCTGCTGAATTTAAATACATGGTTGCTAATGGACTTCATGCACCATATGGACCTTTTGTATGCACCTTTGGTTATCATTTCAA 10764
AATCCACTCACGACGACTTAAATTTATGTACCAACGATTACCTGAAGTACGTGGTATACCTGGAAAACCTGTAACCAATAGTAAGTTT
F K V S A A E F K Y M V A N G L H A P Y G P F D A L W L S F K
Replicase 1a

TTACTTGGTATTGGTGGTGACCGTTGTATAAAATTTCAACTGTCCAATCCAACTGACTGATTGAAGTGACTAATGTTGTGTTATTGGG 10856
AATGAACCATAACCACCACTGGCAACATATTTTAAAGTTGACAGGTTAGGTTTGACTGACTAACTTCACATGATTACAACACAATAACCC
L L G I G G D R C I K I S T V Q S K L T D L K C T N V V L L G
Replicase 1a

TTGTTTGTCTAGTATGAACATTGCAGCTAATTCTAGTGAATGGGCTTATTGTGTTGATTTACACAATAAGATTAATCTTTGTGATGACCCAG 10948
AACAAACAGATCATACTTGTAACTGCGATTAAGATCACTTACCGAATAACACAATAAATGTGTTATTCTAATTAGAAACACTACTGGGTC
C L S S M N I A A N S S E W A Y C V D L H N K I N L C D D P
Replicase 1a

AAAAAGCTCAAGGTATGTTGTTAGCACTCCTTGGCTTCTTCTAAGTAAACATAGTGATTTTGGTCTTGATGGCCTTATTGATTCTTATTTT 11040
TTTTTCGAGTTCCATACAACATCGTGAGGAACGCAAGAAAGATTCAATTGTTATCACTAAAACAGAACTACCGGAATAACTAAGAATAAAA
E K A Q G M L L A L L A F F L S K H S D F G L D G L I D S Y F
Replicase 1a

GATAATAGTAGCACCTGCAGAGTGTGCTTCATCTTTGTTAGTATGCCATCATATATGCTTATGAAAATGCTAGACAAGCTTATGAGGA 11132
CTATTATCATCGTGGGACGTCTCACAACGAAGTAGTAAACAATCATACGGTAGTATATAACGAATACTTTACGATCTGTTTCAATACTCCT
D N S S T L Q S V A S S F V S M P S Y I A Y E N A R Q A Y E D
Replicase 1a

TGCTATTGCTAATGGATCTTCTTCTCACTTATTAACAATTGAAGCGTGCCATGAATATCGCAAAGTCTGAATTTGATCATGAGATATCTG 11224
ACGATAACGATTACCTAGAAGAAGAGTTGAATAATTTGTTAACTTCGCACGGTACTTATAGCGTTTCAGACTTAACTAGTACTCTATAGAC
A I A N G S S S Q L I K D L K R A H N I A K S E F D H E I S
Replicase 1a

TTCAGAAGAAAATTAATAGAATGGCTGAACAAGCTGCTACTCAGATGTATAAGAAGCAGCTCTGTTAATAGAAAATCTAAAGTTATTAGT 11316
AAGTCTCTTTTAATTATCTTACCGACTTGTTCGACGATGAGTCTACATATTTCTTCGTGCGAGACAATTATCTTTAGATTTCATAATCA
V Q K K I N R H A E Q A A T O M Y K E A R S V N R K S K V I S
Replicase 1a

GCTATGCACTCTTTACTTTTTGGAATGTTAAGACGTTTGATATGTCTAGTGTGAACTGTTTGAATTTAGCACGTGATGGTGTGTGCC 11408
CGATACGTGAGAAATGAAAACCTTACAATTCTGCAACCTATACAGATCACAACCTTGACAAAACCTTAATCGTCACTACCAACAACCGG
A M H S L L F G M L R R L D M S S V E T V L N L A R D G V V P
Replicase 1a

ATTGTCAGTTATACCTGCAACTTCAGCTTCCAACTAACTATTGTTAGTCCAGATCTTGAATCTTATTCTAAGATTGTTGTGATGGTTCTG 11500
TAACAGTCAATATGGAGCTGAAGTGAAGGTTGATTGATAACAATCAGGTCTAGAAGTCTAGAATAAGATTCTAACAACACTACCAAGAC
L S V I P A T S A S K L T I V S P D L E S Y S K I V C D G S
Replicase 1a

TTCATTATGCTGGAGTTGTTTGGACACTTAATGATGTTAAGACAATGATGGTAGACCTGTTTATGTTAAGAGATTACAAGGGAGAATGTT 11592
AAGTAATACGACCTCAACAAACCTGTGAATTACTACAATTTCTGTTACTACCATCTGGACAAGTACAATTTCTCTAATGTTCCCTCTTACAA
V H Y A G V V W T L N D V K D N D G R P V H V K E I T R E N V
Replicase 1a

GAAACTTTGACATGGCCTCTTATCCTTAATTGTGAACGTGTTGTTAACTTCAAATAATGAAATTATGCCTGGTAACTTAAGCAAAAACC 11684
CTTTGAAACTGTACGGGAGAATAGGAATTAACACTTGCACAACAATTTGAAGTTTATTACTTTAATACGGACCATTTGAATTCGTTTTTGG

E T L T W P L I L N C E R V V K L O N N E I M P G K L K Q K P
Replicase 1a

TATGAAAGCTGAGGGTGATGGTGGTGTITAGGTGATGGTAATGCTTTGTATAATACTGAGGGTGGTAAACTTTTATGTATGCTTATATTT 11776
ATACTTTGACTCCCACTACCACCACAAAATCCACTACCATTACGAAACATATTGACTCCCACTTTTGAAAATACATACGAATATAAA

H K A E G D G G V L G D G N A L Y N T E G G K T F M Y A Y I
Replicase 1a

CTAATAAGCTGACCTTAAATTTGTTAAGTGGGAGTATGAGGGTGGTGAACACAATCGAGTTAGACTCTCCTTGTGCGATTTATGGTCGAA 11868
GATTATTTGACTCGGAATTTAAACAATTCACCTCATCTCCCAACAGTTGTGTTAGCTCAATCTGAGAGGAACAGCTAAATACCAGCTT

S N K A D L K F V K W E Y E G G C N T I E L D S P C R F M V E
Replicase 1a

ACACCTAATGGTCTCAAGTGAAGTATTTGTATTTTGTAAAAATTTAAATACCTTACGTAGAGGTGCCGTTCTTGGTTTTATAGGTGCCAC 11960
TGTGGATTACCAGGAGTTCACCTCATAAACATAAAACAATTTTAAATTTATGGAATGCATCTCCACGGCAAGAACAAAATATCCACGGTG

T P N G P Q V K Y L Y F V K N L N T L R R G A V L G F I G A T
Replicase 1a

AATTCGTCTACAAGCTGGTAAACAACTGAATTGGCTGTTAATCTGACTTTTAACTGCTTGTGCTTTTTCTGTTGATCCAGCAACCACTT 12052
TTAAGCAGATGTTGCGACCATTTGTTTGACTTAACCGACAATTAAGACCTGAAAATGACGAACACGAAAAGACAACCTAGGTCGTTGGTGAA

I R L O A G K O T E L A V N S G L L T A C A F S V D P A T T
Replicase 1a

ACTTGAAGCTGTTAAACATGGTGCAAAACCTGTAAGTAATGTATTAAGATGTTATCTAATGGTCTGGTAATGGTCAAGCTATAACAAC 12144
TGAACCTTCGACAATTTGTACCACGTTTGGACATTCATTAACATAATTCTACAATAGATTACCACGACCATACCAGTTTCGATATTGTTGA

Y L E A V K H G A K P V S N C I K M L S N G A G N G O A I T T
Replicase 1a

AGTGTAGATGCTAACCAATCAAGATTCTTATGGTGGAGCGTCTATTTGTTTGTATTGTGCGGCCACGTTCTCACCCTAGTATGGATGG 12236
TCACATCTACGATTGTGGTTAGTTCTAAGAATACCACCTCGCAGATAAACAAACATAACAGCCGGGTGCAAGGAGTGGGATCATACCTACC

S V D A N T N O D S Y G G A S I C L Y C R A H V P H P S M D G
Replicase 1a

TTACTGTAAGTTTAAGGGTAAATGTGTTCAAGTTCTATTGGTTGTTTGGATCTATTAGGTTTTGTTTAGAAAATAATGTGTGAATGTTT 12328
AATGACATTCAAATTCCTTTACACAAGTCAAGGATAACCAACAACTAGGATAATCCAAAACAAATCTTTTATTACACATTACAAA

Y C K F K G K C V O V P I G C L D P I R F C L E N N V C N V
Replicase 1a

GTGGTTGTTGGTTGGGACACGGGTGTGCTTGTGATCGTACAACCATTCAAAGTGTGACATTTCTTATTTAAACGAGCAAGGGTTCTAGTG
CACCACAACCAACCTGTGCCACACGAACACTAGCATGTTGGTAAGTTTCACAACGTAAAGAATAAATTTGCTCGTTCCCAAGATCAC 12420
C G C W L G H G C A C O R T T I O S V D I S Y L N E O G V L V
Replicase 1a
R A R G S S
Replicase 1b
CAGCTCGACTAGAACCTGTAAATGGCACGGACATCGATAAGTGTTCGTGCTTTTGACATTTATAATAAAATGTTTCATTCTTGGGTAAG
GTCGAGCTGATCTTGGGACATTACCCTGCTGTAGCTATTACACAAGCACGAAAACGTAAATATTATTTTACAAAGTAAGAACCATTTC 12512
Q L D
-Replicase 1a-
A A R L E P C N G T D I O K C V R A F D I Y N K N V S F L G K
Replicase 1b
TGTTTGAAGATGAACCTGTTCGTTTTAAAAATGCTGATCTTAAGGATGGTTATTTTGTATAAAGAGGTGTACTAAGTCGGTTATGGAACA
ACAACTTCTACTTGACACAAGCAAAATTTTACGACTAGAATTCCTACCAATAAAACAATATTTCTCCACATGATTACGCAATACCTTGT 12604
C L K M N C V R F K N A D L K D G Y F V I K R C T K S V M E H
Replicase 1b
CGAGCAATCCATGTATAACCTACTTAACTTTTCTGGTGGCTTTGGCTGAGCATGATTTCTTTACTTGGAAAGATGGCAGAGTCATTTATGGTA
GCTCGTTAGGTACATATTGGATGAATTGAAAAGACCACGAAACCGACTCGTACTAAAGAAATGAACCTTTCTACCGTCTCAGTAAATACCAT 12696
E O S M Y N L L N F S G A L A E H D F F T W K D G R V I Y G
Replicase 1b
ATGTTAGTAGACATAATCTTACTAAATATACATGATGGACTTGGTTTATGCTATGCGTAACCTTTGATGAACAAAATTTGTGATGTTCTAAAA
TACAATCATCTGTATTAGAATGATTTATATGATACTACTGAACCAATACGATACGCATTGAAACTACTTGTTTTAACTACATAAGATTTT 12788
N V S R H N L T K Y T M M D L V Y A M R N F D E O N C D V L K
Replicase 1b
GAAGTATTAGTTTTAACTGGTTGTTGTGACAATCTTATTTTGATAGTAAGGGTTGGTATGACCCAGTTGAAAATGAAGATATACATAGAGT
CTTCATAATCAAAATTGACCAACAACACTGTTAAGAATAAACTATCATTCCCAACCATACTGGGTCAACTTTTACTTCTATATGTATCTCA 12880
E V L V L T G C C O N S Y F D S K G W Y D P V E N E D I H R V
Replicase 1b
TTATGCATCTCTTGGCAAAATTTAGCTAGAGCTATGCTTAAATGCGTTGCTCTATGTGATGCGATGGTTGCTAAAGGTGTTGTTGGTGT
AATACGTAGAGAACCGTTTTAATCATGATCTCGATACGAATTTACGCAACGAGATACACTACGCTACCAACGATTTCCACAACAACCACAA 12972
Y A S L G K I V A R A M L K C V A L C D A M V A K G V V G V
Replicase 1b
TAACATTAGATAACCAAGATCTTAATGGTAACCTTTATGATTTTGGTGATTTTGTGTTAGCTTACCTAATATGGGTGTTCCCTGTTGTACA
ATTGTAATCTATTGGTTCTAGAATTACCATTGAAAATACTAAAACCACTAAACAACAATCGAATGGATTATACCCACAAGGGACAACATGT 13064
L T L D N O D L N G N F Y O F G D F V V S L P N H G V P C C T
Replicase 1b

TCATATTATTCTTATATGATGCCTATTATGGGTTTAACTAATTGTTTAGCTAGTGAGTGTTTTGTCAAGAGTGATATTJTTGGTAGTGATTT 13156
AGTATAATAAGAAATATACTACGGATAATACCCAAATTGATTAACTAATCGATCACTCACAACAGTTCTCACTATAAAACCATCACTAAA
S Y Y S Y M M P I M G L T N C L A S E C F V K S D I F G S D F
Replicase 1b

TAAACCTTTTGATTTGCTTAAGTATGATTTCACTGAACATAAGAAAAATTTATTCAATAAGTACTTTAAGCATTGGAGTTTTGATTATCATC 13248
ATTTTGAAAACCTAAACGAATTCATACTAAAGTGACTTGTATTTCTTTAAATAAGTTATTCATGAAATTCGTAACCTCAAACTAATAGTAG
K T F D L L K Y D F T E H K E N L F N K Y F K H W S F D Y H
Replicase 1b

CTAATTGTAGTGACTGTTATGATGATATGTGTGTATACATTGTGCTAATTTAATACACTATTTGCCACAACATACCAGGTACTGCTTTT 13340
GATTAACTCACTGACAATACTACTATACACACAATATGAACAGGATTAATAATATGTGATAAACGGTGTGATATGGTCCATGACGAAAA
P N C S D C Y D D M C V I H C A N F N T L F A T T I P G T A F
Replicase 1b

GGTCCACTATGTCGTAAAGTTTTATAGATGGTGTCCACTTGTACAACCTGCTGGTTATCATTTTAAGCAATTAGGTTTGGTTTGAATAA 13432
CCAGGTGATACAGCATTTCAAAAATATCTACCACAAGGTGAACAATGTTGACGACCAATAGTAAATTCGTTAATCCAAACCAACCTTATT
G P L C R K V F I D G V P L V T T A G Y H F K O L G L V W N K
Replicase 1b

AGATGTTAACACACTCAGTTAGGTTGACAATCACTGAACCTTTGCAATTTGTTACTGACCCCTTCCTTGATAATAGCTTCTCTCCAGCAC 13524
TCTACAATTGTGTGTGAGTCAATCCAACCTGTTAGTGACTTGAAAACGTTAAACAATGACTGGGAAGGAACATTATCGAAGAAGAGGTCGTG
D V N T H S V R L T I T E L L O F V T D P S L I I A S S P A
Replicase 1b

TCGTTGATCAACGCACTATTGTTTTCTGTTGAGCATTGAGTACTGGTTTGACAAATCAAGTTGTTAAGCCAGGTCATTTTAATGAAGAG 13616
AGCAACTAGTTGCGTGATAAACAAGAACGACGTCGTAACCTCATGACCAACTGTTTGTTCACAATTCGGTCCAGTAAATTAATCTCTC
L V D O R T I C F S V A A L S T G L T N O V V K P G H F N E E
Replicase 1b

TTTTATACTTTCTTCGTTTAAGAGGTTTCTTTGATGAAGGTTCTGAACCTTACATTAACATTTCTTCTCGCACAGAATGGTGATGCTGC 13708
AAAATATTGAAAGAAGCAATTTCTCAAGAACTACTTCCAAGACTTGAATGTAATTTGTAAAGAAGAAGCGTGCTTACCACTACGACG
F Y N F L R L R G F F D E G S E L T L K H F F F A O N G O A A
Replicase 1b

TGTTAAAGATTTTGACTTTTACCGTTATAATAAGCCTACCATTTTATGATATTTGTCAAGCTAGAGTTACATATAAGATAGTCTCTCGTTATT 13800
ACAATTTCTAAAACCTGAAATGGCAATATTTCGGATGGTAAATCTATAAACAGTTGATCTCAATGTATATTCTATCAGAGAGCAATAA
V K D F D F Y R Y N K P T I L D I C Q A R V T Y K I V S R Y
Replicase 1b

TTGACATTTTGAAGGTGGCTGTATTAAAGCATGTGAAGTTGTTGAACAACTTTAATAAGAGTGCTGGTTGGCCATTAATAAGTTTGGT 13892
AAGTGAATACTTCCACCGACATAATTCCGTACACTCAACAACATGTTTGAATTAATTTCTCAGGACCAACCGTAATTTATTCAAACCA
F D I Y E G G C I K A C E V V V T N L N K S A G W P L N K F G
Replicase 1b

AAAGCTAGTTTGTATTACGAATCTATATCTTATGAAGAACAGGATGCTTTGTTTGTCTTGACAAAGCGTAATGTCCTCCCTACTATGACACA 13984
TTTCGATCAAACATAATGCTTAGATATAGAATACTTCTTGCTACGAAACAAAGAACTGTTTCGCATTACAGGAGGGATGATACTGTGT
K A S L Y Y E S I S Y E E O D A L F A L T K R N V L P T M T O
Replicase 1b

GCTGAATCTTAAGTATGCTATTAGTGGTAAAGAACGTGCTAGAACTGTTGGTGGTGTCTCTGTGTGTCACAATGACCACAAGACAATACC 14076
CGACTTAGAATTCATACGATAATCACCATTCTTGCAAGATCTTGACAACCACCACAAAGAGACAACAGGTGTTACTGGTGTCTGTATGG
L N L K Y A I S G K E R A R T V G G V S L L S T M T T R Q Y
Replicase 1b

ATCAAAAACATCTTAATCCATTGTTAATACACGCAATGCCACTGTTGTTATTGGTACTACCAAATTTTATGGTGGTTGGAATAATATGTTG 14168
TAGTTTTGTAGAATTTAGGTAACAATTATGTGCGTTACGGTGACAACAATAACCATGATGGTTTAAATACCACCAACCTTATTATACAAC
H O K H L K S I V N T R N A T V V I G T T K F Y G G W N N M L
Replicase 1b

CGTACTTTAATTGATGGTGTGAAAACCTATGCTCATGGTGGGATTATCCCAAATGTGATAGAGCTTTGCCCTAACATGATACGTATGAT 14260
GCATGAAATTAACACCACAACCTTTGGGATACGAGTACCCAACCTAATAGGGTTTACACTATCTGAAACGGATTGTACTATGCATACTA
R T L I D G V E N P M L H G W D Y P K C D R A L P N M I R M I
Replicase 1b

TTACGCCATGGTGTGGGTTCTAAGCATGTTAATTGTTGTACTGTAACAGATAGGTTTTATAGGCTTGGTAACGAGTTGCCACAAGTTTTAA 14352
AAGTCGGTACCACAACCAAGATTGTAACAATTAACAACATGACATTGTCTATCCAAATATCCGAACCATGCTCAACCGTGTTCAAAATT
S A M V L G S K H V N C C T V T D R F Y R L G N E L A O V L
Replicase 1b

CAGAAGTTGTTTATTCTAATGGTGGTTTTATTTAAGCCAGGTGGTACGACTTCTGGTGACGCTAGTACAGCTTATGCTAATTTCTATTTT 14444
GTCTTCAACAAATAAGATTACCACCAAAAATAAATTTCGGTCCACCATGCTGAAGACCACTGCGATCATGTCGAATACGATTAAAGATAAAA
T E V V Y S N G G F Y F K P G G T T S G D A S T A Y A N S I F
Replicase 1b

AACATTTTTCAAGCCGTGAGTTCTAACATTAACAGGTGCTTAGTGTCCCATCAGATTCATGTAATAATGTTAATGTTAGGGATCTACAACG 14536
TTGTAAGAAAGTTCGGCACTCAAGATTGTAATTGTCCAACGAATCAGGGTAGTCTAAGTACATTATTACAATTACAATCCCTAGATGTTGC
N I F O A V S S N I N R L L S V P S D S C N N V N V R D L O R
Replicase 1b

ACGTCTGTATGATAATTGCTATAGGTTAACTAGTGTGAAGAGTCATTCATTGATGATTATTATGGTTATCTTAGGAAACATTTTCAATGA 14628
TGCAGACATACTATTAACGATATCCAATTGATCACAACCTCTCAGTAAGTAACCTAATAATACCAATAGAATCCTTTGTAAGAAAGTTACT
R L Y O N C Y R L T S V E E S F I O D Y Y G Y L R K H F S M
Replicase 1b

TGATTCCTCTGATGACGGTGTGTCTGTTATAACAAGGATTATGCTGAGTTAGGTTATATAGCAGACATTAGTGCTTTTAAAGCCACTTTG 14720
ACTAAGAGAGACTACTGCCACAACAGACAATATTGTTCTAATACGACTCAATCCAATATATCGTCTGTAATCACGAAAATTCGGTGAAAC
M I L S O D G V V C Y N K D Y A E L G Y I A D I S A F K A T L
Replicase 1b

20/87

AGACTCTTTGCGGCTGAACTATTAAGCTAAAGAAGAGAGTGTAAAGTCTTCTATGCTTTTGCAACTCTTAAGAGGTTGTTGGACCTAA
TCTGAGAAACGCCGACTTTGATAAATTCGATTCTTCTCTCACAATTCAGAAGAATACGAAAACGTTGAGAATTTCTCCAACAACCTGGATT

15640

R L F A A E T I K A K E E S V K S S Y A F A T L K E V V G P K
Replicase 1b

AGAATTGCTTCTTAGTTGGGAAAGTGGTAAAGTTAAACCACCTTTGAATCGTAATTCGTTTTACCTGTTTTCAAATAAGTAAGGACTCAA
TCTTAACGAAGAATCAACCTTTACCATTTCAATTTGGTGGAACTTAGCATTAGACAAAAGTGGACAAAAGTTATTCAATCTCGAGTT

15732

E L L L S W E S G K V K P P L N R N S V F T C F Q I S K D S
Replicase 1b

AATTCCAAATAGGTGAGTTCATCTTTGAAAAGGTTGAATATGGTTCGATACTGTTACGTATAAGTCTACTGTAACTAAGTTAGTTCTCT
TTAAGGTTTATCCACTCAAGTAGAACTTTTCCAACCTATACCAAGACTATGACAATGCATATTCAGATGACATTGGTGATTCAATCAAGGA

15824

K F Q I G E F I F E K V E Y G S D T V T Y K S T V T T K L V P
Replicase 1b

GGTATGATTTTGTCTTAACATCTCACAATGTTCAACCTTTACGTGCACCAACTATTGCAAACCAAGAGAAGTATTCTAGCATTATATAAAT
CCATACTAAAAACAGAATTGTAGAGTGTACAAAGTGGAAATGCAGTGGTTGATAACGTTTGGTTCTCTTCATAAGATCGTAATATTTAA

15916

G M I F V L T S H N V O P L R A P T I A N Q E K Y S S I Y K L
Replicase 1b

GCACCTGCTTTAATGTCAGTGATGCATATGCTAATTTGGTTCATATTACCAACTTATTGGTAAACAAAAGATAACTACAATACAGGGTC
CGTGGGACGAAAATTACAGTCACTACGTATACGATTAACCAAGGTATAATGGTTGAATAACCATTTGTTTTCTATTGATGTTATGTCACG

16008

H P A F N V S D A Y A N L V P Y Y O L I G K O K I T T I O G
Replicase 1b

CTCTGGTAGTGGTAAGTCACATTGTTCCATTGGACTTGGATTGTACTATCCAGGTGCGCGTATTGTTTTGTTGCTTGTGCCCATGCTGCT
GAGGACCATCAACATTCAGTGTAAACAGGTAACTGAACCTAACATGATAGGTCCACGCGCATAACAAAACAACGAACAGGGTACGACGA

16100

P P G S G K S H C S I G L G L Y Y P G A R I V F V A C A H A A
Replicase 1b

GTTGATTCCTTATGTGAAAAGCTATGACTGTTTATAGCATTGATAAGTGTACTAGGATTATACCTGCAAGAGCTCGGGTTGAGTGTATAG
CAACTAAGGAATACAGCTTTTCGATACTGACAAATATCGTAACATTACATGATCCTAATATGGACGTTCTCGAGCCCAACTCACAATATC

16192

V D S L C A K A M T V Y S I D K C T R I I P A R A R V E C Y S
Replicase 1b

TGGCTTTAAACCAAATAACACTAGTGCACAATACATATTAGCACTGTAAACGCATTACCTGAGTGAATGCTGATATTGTTGTTGATGATG
ACCGAAATTTGGTTTATTGTGATCAGTGTATGTATAAATCGTGACAATTGCGTAATGGACTCACATTACGACTATAACAACAACATCTAC

16284

G F K P N N T S A O Y I F S T V N A L P E C N A D I V V V D
Replicase 1b

AAGTTTCAATGTGTACAAATATGACCTTTCTGTTATTAATCAGCGTTTATCATATAAACATATTGTTTATGTTGGTGATCCACAACAATT
TTCAAAGTTACACATGTTTAATCTGGAAGACAATAATTAGTCGCAATAGTATATTGTATAACAATACAACCACTAGGTGTTGTTGAA

16376

E V S M C T N Y D L S V I N O R L S Y K H I V Y V G D P O O L
Replicase 1b

CCTGCACCTAGAGTAATGATTACTAAAGGTGTTATGGAGCCTGTTGATTATAACGTTGTTACTCAACGTATGTGTGCTATAGGCCCTGATGT
GGACGTGGATCTCATTACTAATGATTTCCACAATACCTCGGACAACATAATTGCAACAATGAGTTGCATACACAGATATCCGGGACTACA 16468
P A P R V M I T K G V H E P V D Y N V V T O R M C A I G P D V
Replicase 1b

TTTCTTCATAAATGTTATAGATGCTGCTGAAATAGTTAATACAGTTTCTGAACTTGTATTGAGAACAAGTTTGCCCTGTTAAACCTG
AAAAGAAGTATTACAATATCTACAGGACGACTTTATCAATTATGTCAAAGACTTGAACAAATACTCTTGTTCAAACAGGACAATTGGAC 16560
F L H K C Y R C P A E I V N T V S E L V Y E N K F V P V K P
Replicase 1b

CTAGTAACAGTGTTTTAAATCTTTTTAAGGGTAATGTACAGGTGACAATGGCTCTAGTATTAAACAGAAAGCAGCTTGAAATAGTTAAG
GATCATTGTGCACAAATTTTAGAAAAATCCCAATACATGTCCAACGTGTACCGAGATCATAATTGTCTTTCGTGCAACTTTATCAATTC 16652
A S K O C F K I F F K G N V O V O N G S S I N R K O L E I V K
Replicase 1b

CTGTTTTAGTTAAAAATCCAAGTTGGAGTAAGGCTGTGTTTATTTCTCCTTATAATAGTCAGAATTATGTTGCTAGTAGATTTTAGGACT
GACAAAAATCAATTTTAGGTTCAACCTCATTCCGACACAAATAAGAGGAATATTATCAGTCTTAATACAACGATCATCTAAAAATCTGTA 16744
L F L V K N P S W S K A V F I S P Y N S O N Y V A S R F L G L
Replicase 1b

TCAAATTCAACTGTTGATTCTTCTCAAGGTAGTGAGTATGATTATGTAATCTATGCACAACTTCTGACACTGCACATGCTTGCAATGTAA
AGTTTAAGTTTGACAACTAAGAAGAGTTCCATCACTCATACTAATACATTAGATACGTGTTTGAAGAGCTGACGTGTACGAACGTTACATT 16836
D I D T V D S S O G S E Y D Y V I Y A O T S D T A H A C N V
Replicase 1b

ACCGTTTTAATGTTGCTATAACACGTGCTAAGAAGGTATATTTGTGTAATGTGTGATAAACTTTGTTTGATTCACTTAAGTTTTTGAG
TGCAAAATACACGATATTGTGCAGGATCTTCCATATAAAACACATTACACACTATTTGAAACAACTAAGTGAATTCAAAAAAGCTC 16928
N R F N V A I T R A K K G I F C V M C D K T L F D S L K F F E
Replicase 1b

ATTAACATGCAGATTTACACTCTAGCCAGGTTTGTGGCTGTTTAAAAATGTACACGCACTCCTCTTAATTTACCACCAACTCATGCACA
TAATTTGTACGTCTAAATGTGAGATCGGTCCAACACCGAACAATTTTAAACATGTGCGTGAGGAGAATTAAATGGTGGTTGAGTACGTGT 17020
I K H A D L H S S O V C G L F K N C T R T P L N L P P T H A H
Replicase 1b

CACTTCTTGTGCTGTCAGATCAGTTTAACTACAGGTGATTAGCTGTTCAAATAGGTTCAAATAATGTTTGTACTTATGAACATGTTA
GTAAAGAACAGCAACAGTCTAGTCAAATCTGATGTCCACTAAATCGACAAGTTTATCCAAGTTTATTACAAACATGAATACTTGTACAAT 17112
T F L S L S D O F K T T G O L A V O I G S N N V C T Y E H V
Replicase 1b

TATCATTTATGGGTTTTAGGTTTGATATTAGTATTCCTGGTAGTCATAGTTTGTGTTGTACACGTGACTTTGCTATTGTAATGTGCGTGT
ATAGTAATACCCAAATCCAACATAATCATAAGGACCATCAGTATCAACAAACATGTGCACTGAAACGATAAGCATTACACGCACCA 17204
I S F M G F R F D I S I P G S H S L F C T R D F A I R N V R G
Replicase 1b

TGGTTGGGATGGATGTTGAAAGTGCTCATGTTTGTGGCGATAACATAGGTACTAATGTTCTTTACAGSTTGGTTTTCAAATGGTGTTAA 17296
ACCAACCCATACCTACAACTTTCACGAGTACAAACACCGCTATTGTATCCATGATTACAAGGAAATGTCCAACCAAAAAGTTTACCACAATT
W L G M D V E S A H V C G D N I G T N V P L O V G F S N G V N
Replicase 1b

TTTTGTTGTGCAAACTGAAGGTTGTGTCTACCAATTTTGGTGATGTTATTAACCTGTTTGTGCAAAATCTCCACCAGGTGAACAATTTA 17388
AAAACAACACGTTTGACTTCCAACACACAGATGGTTAAACCACTACAATAATTGGACAAACACGTTTATAGAGGTGGTCCACTTGTATAAT
F V V Q T E G C V S T N F G D V I K P V C A K S P P G E Q F
Replicase 1b

GACACCTTGTTCCTTTTTACGTAAAGGACAACCTTGGTTAATTGTTCTGACGCGATTGTGCAAAATGATATCTGATTATTTGTCCAATTTG 17480
CTGTGGAACAAGGAAAAATGCATTTCTGTTGGAACCAATTACAAGCATCTGCGTAACACGTTTACTATAGACTAATAACAGGTTAAAC
R H L V P F L R K G Q P W L I V R R R I V Q M I S D Y L S N L
Replicase 1b

TCTGACATTCTTGTCTTTGTTTGTGGGCAGGTAGTTTGAATTAACATAATGCGTTACTTTGTAAAAATAGGGCCAATTAATATTGTTA 17572
AGACTGAAGAACAGAAACAAACACCGTCCATCAAACCTTAATTGATGTTACGCAATGAACATTTTATCCCGGTTAATTATAACAAT
S D I L V F V L W A G S L E L T T H R Y F V K I G P I K Y C Y
Replicase 1b

TTGTGGTAATCTGCCACTTGTATAATTCAGTTAGTAATGAATATTGTTGTTTTAAACATGCATTGGGTTGTGATTATGTTTACAATCCGT 17664
AACACCATTAAAGCGGTGAACAATATTAAGTCAATCATTACTTATAACAACAAAATTTGTACGTAACCAACACTAATACAAATGTTAGGCA
C G N S A T C Y N S V S N E Y C C F K H A L G C D Y V Y N P
Replicase 1b

ATGCTTTTGATATACAACAGTGGGGTTATGTTGGTTCCCTTGAGCCAGAACCACACACGTTCTGTAACATTATAGAAACGAGCATGATGCT 17756
TACGAAACTATATGTTGTACCCCAATACAACCAAGGAACCTGGTCTTGGTGGTGTGCAAGACATTGTAAGTATCTTTGCTGCTACTACGA
Y A F D I Q Q W G Y V G S L S Q N H H T F C N I H R N E H D A
Replicase 1b

TCTGGTGATGCTGTTATGACACGTTGTTTGGCAGTACATGATTGTTTGTCAAAAATGTTGATTGGACTGTAACGTACCCCTTTATTGCAAA 17848
AGACCACTACGACAATCTGTGCAACAAACCGTCATGTACTAACAAAACAGTTTTTACAATAACCTGACATTGCATGGGGAATAACGTTT
S G D A V M T R C L A V H D C F V K N V D W T V T Y P F I A N
Replicase 1b

TGAGAAATTTATCAATGGCTGTGGCGTAATGTCCAGGGACATGTTGTTGCGCGAGCCTTGAAATTGTATAAACCTAGTGTATTTCATGATA 17940
ACTCTTTAAATAGTTACCGACACCCGATTACAGGTCCCTGTACAACAAGCGGTGGAACITTAACATATTTGGATCACATAAGTACTAT
E K F I N G C G R N V O G H V V R A A L K L Y K P S V I H D
Replicase 1b

TTGGTAATCCTAAAGGTGTACGTTGTGCTGTACTGATGCAAAATGGTACTGTTATGACAAGCAACCTGTTAATAGTAATGTCAAGTTGTTG 18032
AACCATTAGGATTTCCACATGCAACACGACAATGACTACGGTTTACCATGACAATACTGTTGTTGGACAATTATCATTACAGTTCAACAAC
I G N P K G V R C A V T D A K W Y C Y D K O P V N S N V K L L
Replicase 1b

GATTATGATTATGCAACCCATGGTCAACTTGATGGTCTTTGTTTATTCTGGAATTGTAATGTTGATATGTATCCAGAATTTCAATTGTGTG
CTAATACTAATACGTTGGGTACCACTGGAACCTACCAGAAACAATAAGACCTTAACATTACAACATACATAGGCTCTAAAAGTTAACACAC 18124

D Y D Y A T H G Q L D G L C L F W N C N V D M Y P E F S I V C
Replicase 1b

TCGCTTTGACACACGTACTCGTTCTGTTTTAATTTAGAAGGTGTTAATGGTGGTCTCTTTATGTTAACAACATGCGTTTCATACACAG
AGCGAAACTGTGTGCATGAGCAAGACAAAAATTAATCTCCACAATTACCACCAAGAGAAATACAATTGTTGTACGCAAAAGTATGTGGTC 18216

R F D T R T R S V F N L E G V N G G S L Y V N K H A F H T P
Replicase 1b

CATATGATAACGTGCTTTTGTAAATTAACCTATGCCCTTTTTTACTTTGATGACAGTGATTGTGATGTTGTGCAAGAACAAGTTAAT
GTATACTATTGTCAGGAAACAATTTAATTTGGATACGGGAAAAAATGAACTACTGTCACCTAACACTACAACACGTTCTTGTTCATTA 18308

A . Y D K R A F V K L K P M P F F Y F D D S D C D V V . Q E Q V N
Replicase 1b

TATGTACCCCTCGCGCTAGTAGTTGTGTACCGTTGTAATATAGGTGGTGTGTTGTTCAAACATGCAAATTTGTATCAAAAATATGT
ATACATGGGGAAGCGCATCAACACAATGGGCAACATTATATCCACCACGACAACAAGTTTGTACGTTAAACATAGTTTTATACA 18400

Y V P L R A S S C V T R C N I G G A V C S K H A N L Y O K Y V
Replicase 1b

TGAGGCATATAATACATTTACACAGGCTGGTTTTAACATTTGGGTACCACATAGTTTGTATGTTTATAATTTGTGGCAAATTTTATTGAAA
ACTCCGTATATTATGTAATGTGTCGACCAAAATGTAAACCCATGTTGTATCAAACTACAAATATTAAACACCGTTTAAAAATACTTT 18492

E A Y N T F T O A G F N I W V P H S F D V Y N L W O I F I E
Replicase 1b

CTAATTTACAAAGCTTTGAAAATATAGCATTTAATGTTGTAAGGAGGTTTACTGGTGTGATGGTGAGTTACCTGTTGCAGTTGTT
GATTAATGTTTCAGAACTTTTATATCGTAAATTACAACATTTTTTTCCACAAAATGACCACAACCTACCCTCAATGGACACGTCAACAA 18584

T N L O S L E N I A F N V V K K G C F T G V D G E L P V A V V
Replicase 1b

AACGACAAAGTTTTGTTGCTATGGCGATGTTGACAACCTGGTTTTTACAAATAAAACAACATTGCCTACTAATGTTGCTTTTGAATTGTT
TTGCTGTTTCAAAAACAAGCGATACCGCTACAACCTGTTGAACCAAAAATGTTTATTTGTTGTAACGGATGATTACAACGAAAACCTAACAA 18676

N O K V F V R Y G D V D N L V F T N K T T L P T N V A F E L F
Replicase 1b

TGCAAAACGAAAAATGGGTTTAAACCACCATTGCTATTCTCAAAAATCTTGGTGTGTTGCTACATATAAATTTGTTTTATGGGATTATG
ACGTTTTGCTTTTTACCCAAATTGTGGTGGTAACAGATAAGAGTTTTAGAACCACAACAACGATGTATTTAAACAAAATACCTAATAC 18768

A K R K M G L T P P L S I L K N L G V V A T Y K F V L W D Y
Replicase 1b

AAGCTGAAAGACCTTTTACCTCATATACTAAGAGTGATGTAATACACTGATTTTAAAGAGGATGTTTGTGTTTGTGTTTGTGACAATAGTATT
TTCGACTTTCTGAAAAATGGAGTATATGATTCTCATATACATTTATGTGACTAAAATTACTCCTACAAACACAAACAAACTGTTATCATAA 18860

E A E R P F T S Y T K S V C K Y T D F N E D V C V C F D N S I
Replicase 1b

CAGGGTTCGTATGAGCGTTTACGCTTACTACGAACGCTGTTTTATTTTCTACTGTTGTCATTAAAAATTTAACACCTATAAGTTGAATTT
GTCCCAAGCATACTCGCAAAATGCGAATGATGCTTGGCAGAAAATAAAGATGACAACAGTAATTTTAAATTGGGATATTTCAACTTAAA
18952
D G S Y E R F T L T T N A V L F S T V V I K N L T P I K L N F
Replicase 1b

TGGTATGTTGAATGGTATGCCAGTTTCTTCTATTAAGAGTGATAAAGSTGTTGAAAAATTAGTTAATTGGTACACATATGTTCTGAAAAATG
ACCATACAACCTACCATACGGTCAAGAAGATAATTCCTACTATTTCCACAACTTTTAATCAATTAACCATGTGTATACAAGCATTTTTAC
19044
G M L N G M P V S S I K S D K G V E K L V N W Y T Y V R K N
Replicase 1b

GTCAATTTCAAGATCATTATGATGGTTTTTACACTCAAGGTAGGAATTTATCAGACTTTACACCAAGAAGTGATATGGAGTATGATTTCTT
CAGTTAAAGTTCTAGTAATACTACCAAAATGTGAGTTCCATCCTTAAATAGTCTGAAATGTGGTTCTTCACTATACCTCATACTAAAAGAA
19136
G O F O D H Y D G F Y T O G R N L S D F T P R S D M E Y D F L
Replicase 1b

AACATGSATATGGGTGTTTTTATTAATAATATGGTCTTGAGGATTTTAATTTGAACATGTTGTATATGGTGATGTTTCAAAACTACATT
TTGTACCTATACCCACAAAATAATTATTTATACCAGAATCTCTAAATTTAAACTTGTACAACATATACCACTACAAGTTTTTGTATGTA
19228
N M D M G V F I N K Y G L E D F N F E H V V Y G D V S K T T L
Replicase 1b

AGGAGGTCTTCATTTGTTGATATCAGTCTTAGGCTTAGTAAATGGGTGTTTTGAAAGCTGATGATTTTGTCACTGCTTCTGACACAACCT
TCCTCCAGAGTAAACAACATATAGTGCAATCCGAATCATTTTACCCACAAAACCTTCGACTACTAAAACAGTGACGAAGACTGTGTGAA
19320
G G L H L L I S O F R L S K M G V L K A D D F V T A S D T T
Replicase 1b

TGAGGTGCTGACTGTTACTTATCTTAATGAACCTAGTTCAAAAGTTGTTGTACTTATATGGATTTGTTGTTGGACGACTTTGTTACTATA
ACTCCACGACATGACAATGAATAGAATTACTTGAATCAAGTTTTCAACAAACATGAATATACCTAAACAACAACCTGCTGAAACAATGATAT
19412
L R C C T V T Y L N E L S S K V V C T Y M D L L L D D F V T I
Replicase 1b

CTAAAGAGTTTAGATCTTGGTGTAATATCTAAAGTTCATGAAGTTATTATAGATAATAAACCTTATAGGTGGATGTTGTTGGTGTAAGATAA
GATTTCTCAAATCTAGAACCACTTATAGATTTCAAGTACTTCAATAATATCTATTATTGGAATATCCACCTACAACACCACATTTCTATT
19504
L K S L O L G V I S K V H E V I I D N K P Y R W M L W C K D N
Replicase 1b

CCACTTGTCGACTTTTTATCCACAGTTGCAGTCTGCTGAATGGAAGTGGTTATGCTATGCCACAAATTTATAAGCTTCAACGTATGTGTT
GGTGAACAGCTGAAAAATAGGTGTCAACGTCAGACGACTTACCTTCACACCAATACGATACGGTGTAAATATTCGAAGTTGCATACACAA
19596
H L S T F Y P O L O S A E W K C G Y A M P O I Y K L O R M C
Replicase 1b

TGGAACCTTGTAATTTATATAATTATGGTGCTGGTATTAAGTTGCCTAGTGGTATAATGTTAAATGTTGTTAAATACACTCAGCTTTGTCAA
ACCTTGAACATTAAATATATTAATACCACGACCATAATTCAACGGATCACCATTACAATTTACAACAATTTATGTGAGTCGAACAGTT
19688
L E P C N L Y N Y G A G I K L P S G I M L N V V K Y T Q L C O
Replicase 1b

TACCTAAATAGCACTACAATGTGCGTACCTCATAATATGCGTGTGTTTGCCTATGGTGTGGTTCTGACAAAGGTGGCACCTGGTACAAC
ATGGATTTATCGTGATGTTACACGCATGGAGTATTATACGCACAAAACGTGATACCACGACCAAGACTGTTCCACACCGTGGACCATGTTG 19780

Y L N S T T M C V P H N M R V L H Y G A G S D K G V A P G T T
Replicase 1b

TGTTTTAAACGTTGGCTACCACCTGATGCAATAATCATTGATAATGATATCAATGATTATGTTAGTGATGCAGATTTTAGCATTACAGGTG
ACAAAATTTTGCAACCGATGGTGGACTACGTTATTAGTAACATTACTATAGTTACTAATAACAATCACTACGTCTAAAATCGTAATGTCCAC 19872

V L K R W L P P D A I I I D N D I N D Y V S D A D F S I T G
Replicase 1b

ATTGTGCTACTGTTTACCTTGAAGATAAGTTTGACTTACTTATTTCTGATATGATGATGGTAGAATTAATTTGTGATGGTGAACCGTC
TAACACGATGACAAATGGAACCTCTATTCAAACGAATGAATAAGACTATACATACTACCATCTTAATTTAAACACTACCACTTTTGACG 19964

D C A T V Y L E D K F D L L I S D M Y D G R I K F C D G E N V
Replicase 1b

TCTAAAGATGGTTTTTACTTATCTTAATGGTGTATTAGAGAAAAATTAGCTATTGGTGGTAGTGTGCCATTAAGATTACAGAATATAG
AGATTTCTACCAAAAAAATGAATAGAATTACCACAATAATCTCTTTTAAATCGATAACCACCATCACAACGGTAATTCTAATGTCTTATATC 20056

S K O G F F T Y L N G V I R E K L A I G G S V A I K I T E Y S
Replicase 1b

TTGGAATAAGTATCTTTATGAATTAATACAAAGATTTGCTTTTTGGACTTTGTTCTGCACGCTGTGTAATACATCCTCTTCAGAAGCTTTTC
AACCTTATTCATAGAAATCTTAATTATGTTTCTAAACGAAAAACCTGAAACAAGACGTGCAGACAATTATGTAGGAGAAGCTCTTCGAAAAAC 20148

W N K Y L Y E L I O R F A F W T L F C T S V N T S S S E A F
Replicase 1b

TTATTGGTATTAATTATTTAGGTGACTTTATTCAAGGTCCTTTTATAGCTGGTAACACTGTTTCATGCTAATTATATTTTGGCGTAATTCT
AATAACCATAATTAATAATCCACTGAAATAAGTTCCAGGAAATATCGACCATTGTGACAAGTACGATTAATATATAAAACCGCATTAAGA 20240

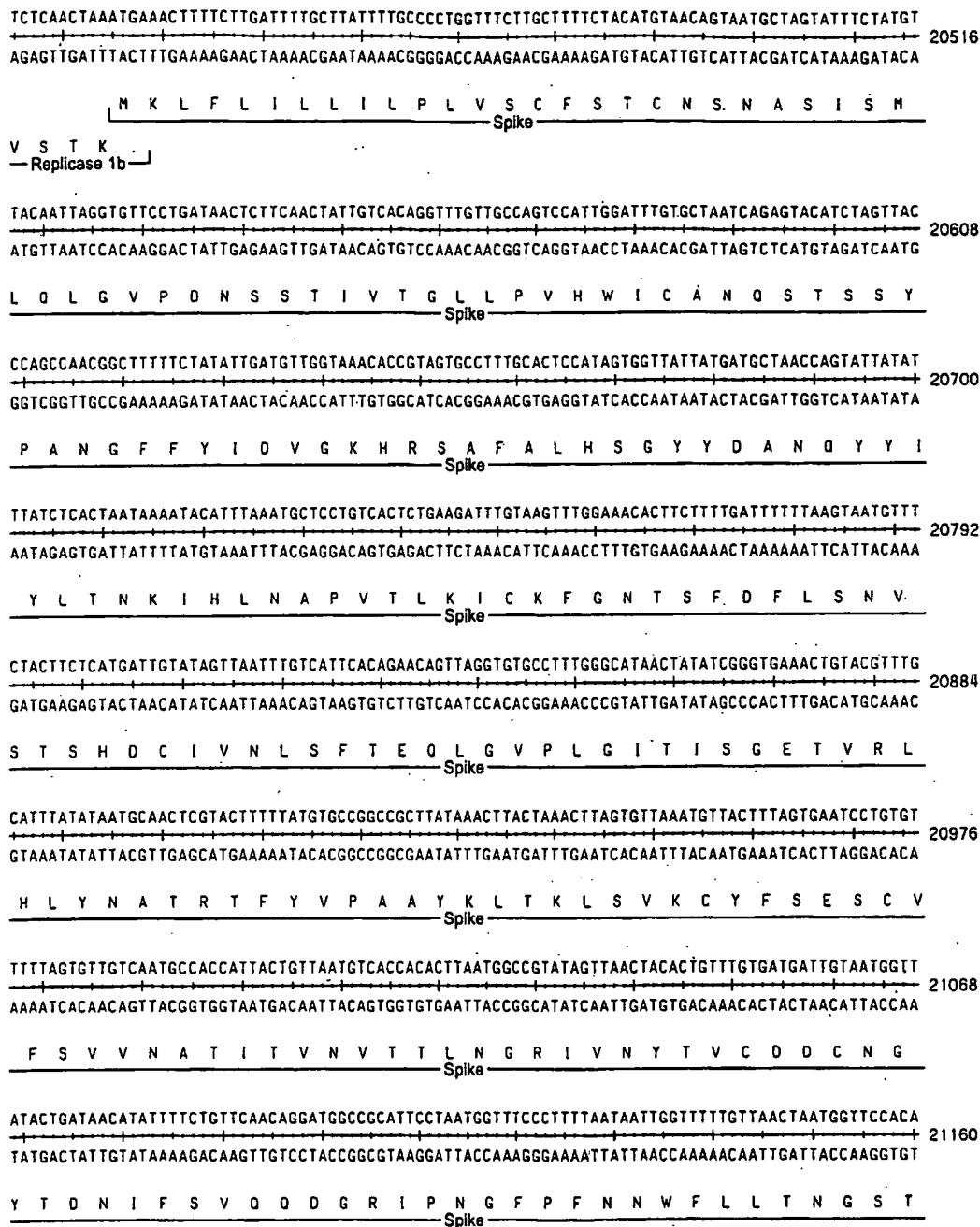
L I G I N Y L G D F I O G P F I A G N T V H A N Y I F W R N S
Replicase 1b

ACTATTATGCTTTGTCATACAATTCAGTTTATAGTTAAGTAAGTTTGAATGTAACATAAGGCCACTGTTGTTGTACACTTAAAGATAG
TGATAATACAGAAACAGTATGTTAAGTCAAAATCTAAATTCATTCAAACCTACATTGTTATTCCGGTGACAACAACAATGTGAATTTCTATC 20332

T I M S L S Y N S V L D L S K F E C K H K A T V V V T L K D S
Replicase 1b

TGATGTAATGATATGGTTTTGAGTTTGATTAAGAGTGGTAGGTTGTTGTTACGTAATAGTGGCCGTTTTGGTGGTTTTAGTAATCATTTAG
ACTACATTTACTATACCAAACTCAAACATAATCTCACCATCCAACAACAATGCATTATCACCGGCAAAACCACCAAAATCATTAGTAAATC 20424

D V N D M V L S L I K S G R L L L R N S G R F G G F S N H L
Replicase 1b



TTAGTGGACGGGGTCTCTAGACTTTATCAACCACTCCGTTTAACTTGTTTATGGCCTGTACCTGGTCTTAAATCTTCAACTGGTTTTGTTA
AATCACTGCCCCAGAGATCTGAAATAGTTGGTGAGGCAAATTGAACAAATACCGGACATGGACCAGAATTTAGAAGTTGACCAAAACAAAT 21252

L V D G V S R L Y O P L R L T C L W P V P G L K S S T G F V Y
Spike

TTTTAATGCCACTGGTCTGATGTTAATTGTAACGGCTATCAACATAATTCTGTTGCTGATGTTATGCGTTACAATCTTAACCTCAGTGCTA
AAAATTACGGTGACCAAGACTACAATTAACATTGCCGATAGTTGTATTAAGACAACGACTACAATACGCAATGTTAGAATTGGAGTCACGAT 21344

F N A T G S D V N C N G Y Q H N S V A D V M R Y N L N L S A
Spike

ATTCTGTGGACAATCTTAAGAGTGGTGTATAGTTTTTAAACTTTACAGTACGATGTTTGTGTTTATGTTAGTAATCTTCTTCAGGTGTT
TAAGACACCTGTTAGAATTCTCACCACAATATCAAAAATTTGAAATGTCATGCTACAAAACAAAATAACATCATTAGAAGAAGTCCACAA 21436

N S V D N L K S G V I V F K T L O Y D V L F Y C S N S S S G V
Spike

CTTGACACCACAATACCTTTTGGCCCTTCTCTCAACCTTATTACTGTTTTATAACAGTACTATCAACACTACTCATGTTAGCACTTTTGT
GAACTGTGGTGTATGGAACCGGGAAGGAGAGTTGGAATAATGACAAAATATTTGTCATGATAGTTGTGATGAGTACAATCGTGAAACA 21528

L D T T I P F G P S S O P Y Y C F I N S T I N T T H V S T F V
Spike

GGGTATTTTACCACCACTGTGCGTGAAATTGTTGTTGCTAGAAGTGGTCAGTTTTATATTAATGGTTTTAAGTATTTGATTGGGTTTCA
CCATAAAATGGTGGTGACACGCACCTTAAACAACGATCTTGACCAGTCAAAATATAATTACCAAAATTCATAAAGCTAAACCCAAAGT 21620

G I L P P T V R E I V V A R T G O F Y I N G F K Y F D L G F
Spike

TAGAAGCTGTCAATTTAATGTCAAGACTGCTAGTGCCACAGATTTTGGACGGTTGCATTTGCTACTTTTGTGATGTTTTGGTTAATGTT
ATCTTCGACAGTTAAAATTACAGTGCTGACGATCACGGTGTCTAAAACCTGCCAACGTAACGATGAAAACAACTACAAAACCAATTACAA 21712

I E A V N F N V T T A S A T D F W T V A F A T F V D V L V N V
Spike

AGTGCACTAACATTCAAACTTACTTTATTGCGATTCTCCATTTGAAAAGTTGCAGTGTGAGCACTTGCAGTTTGGATTGCAAGATGGTTT
TCACGTTGATTGTAAGTTTTGAATGAAATAACGCTAAGAGGTAACTTTTCAACGTCACACTCGTGAACGTCAAACCTAACGTTCTACCAAA 21804

S A T N I O N L L Y C D S P F E K L O C E H L O F G L O D G F
Spike

TTATTCTGCAAATTTCTTGATGATAATGTTTGCCTGAGACTTATGTTGCACTCCCAATTTATTATCAACATACGGACATAAATTTACTG
AATAAGACGTTTAAAGAAGTACTATTACAAAACGACTCTGAATACAACGTGAGGGGTAAATAAGTTGTATGCCTGTATTTAAATGAC 21896

Y S A N F L D D N V L P E T Y V A L P I Y Y O H T D I N F T
Spike

CAACTGCATCTTTTGGTGGTCTTGTGTTGTTGTAACACGCCAGGTTAATATATCTTAAATGGTAACACTTCAGTGTGTTAGAACA
GTTGACGTAGAAAACCAAGAACAATACAAACATTTGGTGGGTCCAATTATATAGAGAATTACCATTGTGAAGTCACACACAATCTTGT 21988

A T A S F G G S C Y V C K P R O V N I S L N G N T S V C V R T
Spike

TCTCATTTTCAATTAGGTATATTATAACCGCTTAAGAGTGGTTCACCAGGTGACTCTTCATGGCATATTTATTTAAAGAGTGGCACTTG
AGAGTAAAAAGTTAATCCATATAAATATTGGCGCAATTCTCACCAGTGGTCCACTGAGAAGTACCGTATAAATAAATTTCTCACCGTGAAC 22080
S H F S I R Y I Y N R V K S G S P G D S S W H I Y L K S G T C
Spike

TCCATTTTCTTTTCTAAGTTAAATAATTTCAAAGTTTAAGACTATTTGTTTCTCAACCGTCAAGTGCCTGGTAGTTGTAATTTCCAC
AGGTAAAGAAAAAGATTCAATTTATTAAGTTTCAAATTCGATAAACAAGAGTTGGCAGCTTCACGGACCATCAACATTAAGGTG 22172
P F S F S K L N N F O K F K T I C F S T V E V P G S C N F P
Spike

TTGAAGCCACCTGGCATTACACTTCTTATACTATTGTTGGTGCTTTGTATGTTACTTGGTCTGAAGGTAATTCATTACTGGTGACCTTAT
AACTCGGTGGACCGTAATGTGAAGAATATGATAACAACCGAAACATACAATGAACCAGACTTCCATTAAGGTAATGACCACATGGAATA 22264
L E A T W H Y T S Y T I V G A L Y V T W S E G N S I T G V P Y
Spike

CCTGCTCTGGTATTCGTGAGTTTAGTAATTTAGTTTTAAATAATTGTACCAATATAATTTATGATTATGTTGGTACTGGAATTATACG
GGACAGAGACCATAAGCACTCAAATCATTAAATCAAATTTATTAACATGGTTTATATTATAAATACTAATACAACCATGACCTTAATATGC 22356
P V S G I R E F S N L V L N N C T K Y N I Y D Y V G T G I I R
Spike

TTCTCAAACCACTGCTGCTGGTGATTACATATGTTTCTAACTCTGGTAATTTACTTGGTTTAAAAATGTTCCACTGGTAACATTT
AAGAAGTTTGGTCACTGAACGACCACCATAAATGTATACAAGATTGAGACCATTAAATGAACCAAAATTTTACAAGGTGACCATTGTAAA 22448
S S N O S L A G G I T Y V S N S G N L L G F K N V S T G N I
Spike

TTATTGTGACACCATGTAACCAACAGATCAAGTAGCTGTTTATCAACAAGCATTATTGGTGCCATGACCGCTGTTAATGAGTCTAGATAT
AATAACACTGTGGTACATTGGTGGTCTAGTTCATCGACAAATAGTTGTTTCTGTAATAACCAAGTACTGGCGACAATTACTCAGATCTATA 22540
F I V T P C N O P D O V A V Y O O S I I G A M T A V N E S R Y
Spike

GGCTTGCAAACTTACTACAGTTACCTAACTTTTATTATGTTAGTAATGGTGGTAACAATTGCACTACGGCTGTTATGATTTATTCTAATTT
CCGAACGTTTGAATGATGTCAATGGATTGAAATAATACAATCAATTACCACCATGTTAACGTGATGCCGACAATACTAAATAAGATTAAA 22632
G L O N L L O L P N F Y Y V S N G G N N C T T A V M I Y S N F
Spike

TGGTATTTGTGCTGATGGTCTTTAATTCCTGTTTCGTCGCGTAATTTCTAGTGATAATGGTATTTTACGCCATAATCACTGCTAATTTATCCA
ACCATAAACAGCACTACCAAGAAATTAAGGACAAGCAGCGCATTAAAGTCACTATTACCATAAAGTCGGTATTAGTGACGATTAATAGGT 22724
G I C A D G S L I P V R P R N S S D N G I S A I I T A N L S
Spike

TTCCCTCTAACTGGACTACTTCAGTTCAAGTTGAGTACCTCCAAATTAAGTACTCCAATAGTTGTTGATTGTGCTACTTATGTGTGTAAT
AAGGGAGATTGACCTGATGAAGTCAAGTTCACTCATGGAGGTTAATGATCATGAGGTTATCAACAACCAACACGATGAATACACACATTA 22816
I P S N W T T S V O V E Y L O I T S T P I V V D C A T Y V C N
Spike

GGTAACCCCTCGTTGTAAGAATCTACTTAAGCAGTATACTTCTGCTTGAAAACTATTGAAGATGCCTTACGACTTAGTGCTCATTGGAAAC
CCATTGGGAGCAACATTCTTAGATGAATTCGTCATATGAAGACGAACATTTTGATAACTTCTACGGAATGCTGAATCACGAGTAAACCTTGG 22908

G N P R C K N L L K O Y T S A C K T I E D A L R L S A H L E T
Spike

TAATGATGTTAGTAGTATGCTAACTTCGATAGCAATGCTTTTAGTTGGCTAATGTTACTAGTTTGGAGATTATAACCTTTCTAGTGT
ATTACTACAATCATCATACGATTGAAAGCTATCGTTACGAAATCAAACCGATTACAATGATCAAACCTCTAATATTGGAAGATCACAAA 23000

N D V S S H L T F D S N A F S L A N V T S F G D Y N L S S V
Spike

TACCTCAGAGAAACATTCATTCAAGCCGTATAGCAGGACGTAGTGCTTTGGAAGATTGTTGTTTAGCAAAGTTGTACATCTGGTTTGGGT
ATGGAGTCTCTTTGTAAGTAAGTTCGGCATATCGTCTGCATCAGAAACCTTCTAACAACAAATCGTTTCAACAATGTAGACCAAAACCA 23092

L P O R N I H S S R I A G R S A L E D L L F S K V V T S G L G
Spike

ACTGTTGATGTTGACTATAAGTCTTGTAAGTCTTTCTATTGCTGACCTTGCTTGTGCTCAGTACTACAATGGCATAATGGTTTGGC
TGACAACTACAATGATATTCAGAATGATTTCCAGAAAGATAACGACTGGAACGAACACGAGTCATGATGTTACCGTATTACCAAAACGG 23184

T V D V D Y K S C T K G L S I A D L A C A O Y Y N G I M V L P
Spike

AGGTGTTGCTGATGCTGAACGTATGGCCATGTACACAGGTTCTTATAGTGGCATGGTGCTCGGAGGTCTTACATCAGCAGCGCCATAC
TCCACAACGACTACGACTTGCATACCGGTACATGTGTCAGAGAATATCCACCGTACCACGAGCCTCCAGAATGTAGTCGTCGGCGGTATG 23276

G V A D A E R H A M Y T G S L I G G M V L G G L T S A A A I
Spike

CTTTTCTTTGGCACTGCAAGCAGCTTAACATATGTTGCTTTACAACTGATGTGCTTCAAGAAAATCAGAAAATTTGGCTGCATCATT
GAAAAGAAACCGTGACGTTGCTGCTGAATTGATACAACGAATGTTTGACTACACGAAGTTCTTTAGTCTTTTAAACCGAGCTAGTAA 23368

P F S L A L O A R L N Y V A L O T D V L O E N O K I L A A S F
Spike

AATAAGGCTATTAATAATATTGTTGCTTTCTTTAGTAGCGTTAATGATGCTATTACACATACTGCAGAGGCTATACATACTGTTACTATTGC
TTATCCGATAATTATTATAACAACGAAGAAAATCATCGCAATTACTACGATAATGTGTATGACGCTCCGATATGTATGACAATGATAACG 23460

N K A I N N I V A S F S S V N D A I T H T A E A I H T V T I A
Spike

ACTTAATAAGATTCAGGATGTTGTTAATCAACAGGAGTAGTGCTTTAACCATCTCACTTCACAATTGAGACATAATTTTCAGGCCATTCTA
TGAATTATTCTAAGTCTTACAACAATTAGTTGTCCCATCAGGAGAAATGGTAGAGTGAAGTGTAACTCTGTATTAAAGTCCGGTAAAGAT 23552

L N K I O D V V N O O G S A L N H L T S O L R H N F O A I S
Spike

ATTCAATTGATGCTATTTATGACCGGCTTGATTCAATTCAAGCCGATCAACAAGTTGACAGATTAACTGGACGGCTTGACGCTTTGAAT
TAAGTTAAGTACGATAAATCTGGCCGAACAAAGTTAAGTTGGGCTAGTTGTTCAACTGTCTAATTAATGACCTGCCGAACGTGAAACCTA 23644

N S I H A I Y D R L O S I O A O O V O R L I T G R L A A L N
Spike

GCATTTGTTTCCCAAGTTTGAATAAATATACTGAAGTTCGTGGTTCAGACGCTTAGCACAGCAGAAGATTAATGAATGTGCAAGTCACA
CGTAAACAAAGGGTTCAAACTTATTTATATGACTTCAAGCACCAAGGTCTGCGAATCGTGTCTTCTAATTACTTACACAGTTCAGTGT 23736

A F V S Q V L N K Y T E V R G S R R L A O O K I N E C V K S O
Spike

ATCTAATAGATATGGTTTTGTGGCAATGGCACTCACATCTTTCAATCGTCAACTCAGCTCCAGATGGTTGCTTTTCTTCACTGTTT
TAGATTATCTATACCAAAACACCGTTACCGTGAGTGTAGAAAAGTTAGCAGTTGAGTCGAGGTCTACCAACGAAAAAGAAGTATGACAAA 23828

S N R Y G F C G N G T H I F S I V N S A P D G L L F L H T V
Spike

TGCTGCCAACTGATTACAAGAATGTAAAGCGTGGTCTGGTATCTGTGTGATGGCATTATGGCTATGTTCTGCGTCAACCTAACTTGGTT
ACGACGGTGTGACTAATGTCTTACATTTCCGACACGACCATAGACACAACCTACCGTAAATACCGATACAAGACGAGTTGGATTGAACCAA 23920

L L P T D Y K N V K A W S G I C V D G I Y G Y V L R O P N L V
Spike

CYTTATTCTGATAATGGTGTCTTTCGTGTAACCTCCAGGGTCACTGTTCAACCTCGTTTACCTGTTTTGCTGATTTTGTGCAAAATATATA
GAAATAAGACTAT, TACCACAGAAAGCACATTGAAGGTCCAGTACAAAGTTGGAGCAAATGGACAAAACAGACTAAAACACGTTTATATATT 24012

L Y S D N G V F R V T S R V M F O P R L P V L S D F V O I Y N
Spike

TTGTAATGTTACTTTTGTTAACATATCTCGTGTGAGTTACATACTGTCATACCTGACTACGTTGATGTTAATAAAACATTACAAGAGTTG
AACATTACAATGAAAACAATTGTATAGAGCACAGCTCAATGTATGACAGTATGGACTGATGCAACTACAATTATTTGTAATGTTCTCAAAC 24104

C N V T F V N I S R V E L H T V I P D Y V O V N K T L O E F
Spike

CACAAAACCTACCAAAGTATGTTAAGCCTAATTTGACTTGACTCCTTTTAATTTAACATATCTTAATTTGAGTTCTGAGTTGAAGCAACTC
GTGTTTGAATGGTTTCATACAATTCGATTAAACTGAACTGAGGAAAATTAATTTGTATAGAATTAACCTCAAGACTCAACTTCGTTGAG 24196

A D N L P K Y V K P N F D L T P F N L T Y L N L S S E L K O L
Spike

GAAGCTAAACCTGCTAGTCTTTTCCAACTACTGTTGAATTACAAGGTCTTATTGATCAGATTAAACAGTACATATGTTGATTTGAAGTTGCT
CTTCGATTTTGACGATCAGAAAAGGTTTGATGACAACCTAATGTTCCGAATAACTAGTCTAATTGTCATGTATACAACCTAACTTCAACGA 24288

E A K T A S L F O T T V E L O G L I D O I N S T Y V D L K L L
Spike

TAATAGGTTTGAAAATTATATCAATGGCCTTGGTGGGTTTGGCTCATTATTTCTGTTGTTTTGTTGATTGTTGAGTCTTCTTGTTGTTTT
ATTATCCAACTTTTAAATATAGTTTACCGGAACCAACCAACCGAGTAATAAGACACAACAAAACAACATAACAACCTCAGAAGAACACAAA 24380

N R F E N Y I K W P W W V W L I I S V V F V V L L S L L V F
Spike

GTTGCTTTCTACAGGTTGTTGTGGTTGTTGCAATTGTTAACTTCATCAATGCGAGGCTGTTGTGATTGTGGTTCAACTAACTTCCTTAT
CAACAGAAAGATGTCCAACACCAACACGTTAACAATGAAGTAGTTACGCTCCGACAACACTAACCAAGTTGATTGAAGGAATA 24472

C C L S T G C C G C C N C L T S S H R G C C D C G S T K L P Y
Spike

TATGAATTTGAAAAGGTCCACGTTCAATAATGCCTTTCGGTGGCCTATTTCAACTTACTCTTGAAAGTACTATTAATAAGAGTGTGGCTAAT
ATACTTAACTTTTCCAGGTGCAAGTTATTACGGAAGCCACCGGATAAAGTTGAATGAGAACTTTCATGATAATTATTCTCACACCGATTA 24564
Y E F E K V H V Q
Spike
M P F G G L F Q L T L E S T I N K S V A N
ORF 4ab

CTCAAATTACCACCTCATGATGTTACTGTCTTGGTGACAATCTTAACTGTTACTACACTTAGTACTATCACTGCTTATTTGTTAGTTAG 24656
GAGTTTAATGGTGGAGTACTACAATGACAGAAGCACTGTTAGAATTTGGACAATGATGTGAATCATGATAGTGACGAATAAACAATCAATC
L K L P P H D V T V L R D N L K P V T T L S T I T A Y L L V S
ORF 4ab

TTTGGTTGCACTTATTTTGTCTTATTCAAACCTCTTACTGCTAGAGGTGCGTGTGCTTGTCTTTGTTTAAACTATTGACACTATCTGTCT 24748
AAACAAACAGTGAATAAAACGAAATAAGTTTGGAGAATGACGATCTCCAGCGCAACGAACAAAACAAAATTTGATAACTGTGATAGACAGA
L F V T Y F A L F K P L T A R G R V A C F V L K L L T L S V
ORF 4ab

ATGTGCCTTTATTGGTTCTTTTGGTATGTATCTTGACAGTTTATAATTTTTTCTACGCTGTTGTTTCGATTCATACATGTTGGCTATT 24840
TACACGGAAATAACCAAGAAAAACCATACATAGAAGTGTCAAAATATTAAAAAAGATGCGACAACAAAGCTAAGTATGTACAACCGATAA
Y V P L L V L F G M Y L D S F I I F F L R C C F D S Y M L A I
ORF 4ab

ATGCCTATCTCTAATAAAAAATTTTCATTTGTTTGTTCATGTTACTAACTATGCTTCGTTTCAGGCAAGTGTGGTATCTTGAACAATC 24932
TACGGATAGAGATTATTTTAAAAAGTAAACAAACAAGTTACAATGATTGTATACGAAGCAAGTCCGTTTACAACCATAGAAGTGTGTTAG
M P I S N K N F S F V L F N V T K L C F V S G K C W Y L E O S
ORF 4ab

ATTTTATGAAATCGTTTGTCTGCTATTTATGGTGGTGACCACTATGTCGTTTGGTGGTGAACTATTACTTTTGTCTTTTGTATGACC 25024
TAAATACTTTTAGCAAAACGACGATAAATACCACCACTGGTGATACAGCAAAATCCACCCTTTGATAATGAAACAAAGAAACTACTGG
F Y E N R F A A I Y G G D H Y V V L G G E T I T F V S F D D
ORF 4ab

TTTATGTTGCTATTAGAGGTTCTTGTGAAAAGAACCTACAACCTATGCGTAAGGTTGACTTGATAATGGTGTGCTCATTTACATTTTGGC 25116
AAATACAACGATAATCTCCAAGAACACTTTTCTGGATGTTGAATACGCAATCCAACTGAACATATTACCACGACAGTAAATGTAACAAACGG
L Y V A I R G S C E K N L O L H R K V D L Y N G A V I Y I F A
ORF 4ab

GAAGAGCCTGTTGTTGGTATAGTTTACTCCTCTCAACTATACGAAGATGTTCTTCGATTAAATTGATGACAATGGCATTGTCCTCAATTCTA 25208
CTTCTCGGACAACAACCATATCAAATGAGGAGAGTTGATATGCTTCTACAAGGAAGCTAATTAACACTGTTACCGTAACAGGAGTTAAGAT
M F L R L I D D N G I V L N S
E E P V V G I V Y S S O L Y E D V P S I N
ORF 4ab

Fig. 3f: Matrix amino acid identity

Seq->	EMCR	229E	PEDV	TGEV	CaCoV	FeCoV	PRCoV	OC43	PHEV	BoCoV	MHV	RatSA	AIBV	SARS
EMCR	1.000	0.615	0.650	0.441	0.429	0.400	0.437	0.317	0.317	0.317	0.303	0.303	0.239	0.286
229E	---	1.000	0.557	0.380	0.372	0.344	0.384	0.317	0.309	0.309	0.299	0.316	0.269	0.277
PEDV	---	---	1.000	0.460	0.452	0.386	0.460	0.351	0.360	0.364	0.358	0.363	0.234	0.303
TGEV	---	---	---	1.000	0.878	0.758	0.958	0.330	0.334	0.346	0.335	0.332	0.208	0.254
CaCoV	---	---	---	---	1.000	0.757	0.878	0.311	0.315	0.326	0.319	0.304	0.192	0.243
FeCoV	---	---	---	---	---	1.000	0.772	0.268	0.279	0.286	0.272	0.265	0.174	0.234
PRCoV	---	---	---	---	---	---	1.000	0.330	0.334	0.346	0.335	0.332	0.215	0.262
OC43	---	---	---	---	---	---	---	1.000	0.934	0.947	0.848	0.818	0.270	0.386
PHEV	---	---	---	---	---	---	---	---	1.000	0.943	0.848	0.818	0.270	0.400
BoCoV	---	---	---	---	---	---	---	---	---	1.000	0.870	0.839	0.278	0.391
MHV	---	---	---	---	---	---	---	---	---	---	1.000	0.938	0.271	0.382
RatSA	---	---	---	---	---	---	---	---	---	---	---	1.000	0.275	0.369
AIBV	---	---	---	---	---	---	---	---	---	---	---	---	1.000	0.262
SARS	---	---	---	---	---	---	---	---	---	---	---	---	---	1.000

Fig. 3g: Nucleoprotein amino acid identity

Seq->	EMCR	229E	PEDV	TGEV	FeCoV	PRCoV	CaCoV	RSDAC	MHV	PHEV	OC43	BoCoV	SARS	AIBV
EMCR	1.000	0.447	0.363	0.331	0.319	0.329	0.339	0.188	0.189	0.179	0.183	0.183	0.214	0.179
229E	---	1.000	0.345	0.333	0.304	0.326	0.330	0.194	0.202	0.192	0.194	0.192	0.203	0.181
PEDV	---	---	1.000	0.279	0.248	0.275	0.275	0.165	0.170	0.164	0.164	0.162	0.182	0.180
TGEV	---	---	---	1.000	0.761	0.963	0.897	0.220	0.221	0.203	0.205	0.203	0.234	0.196
FeCoV	---	---	---	---	1.000	0.756	0.763	0.212	0.213	0.192	0.195	0.197	0.217	0.185
PRCoV	---	---	---	---	---	1.000	0.879	0.220	0.226	0.205	0.207	0.205	0.231	0.192
CaCoV	---	---	---	---	---	---	1.000	0.216	0.220	0.199	0.201	0.199	0.217	0.199
RSDAC	---	---	---	---	---	---	---	1.000	0.894	0.693	0.697	0.697	0.293	0.208
MHV	---	---	---	---	---	---	---	---	1.000	0.680	0.684	0.682	0.290	0.216
PHEV	---	---	---	---	---	---	---	---	---	1.000	0.948	0.953	0.270	0.199
OC43	---	---	---	---	---	---	---	---	---	---	1.000	0.973	0.272	0.203
BoCoV	---	---	---	---	---	---	---	---	---	---	---	1.000	0.274	0.203
SARS	---	---	---	---	---	---	---	---	---	---	---	---	1.000	0.206
AIBV	---	---	---	---	---	---	---	---	---	---	---	---	---	1.000

Fig. 3h: Matrix nucleotide identity

Seq->	SARS	EMCR	229E	PEDV	TGEV	CaCoV	FeCoV	PRCoV	OC43	PHEV	BoCoV	MHV	RatSA	AIBV
SARS	1.000	0.286	0.281	0.303	0.254	0.243	0.258	0.262	0.386	0.400	0.391	0.382	0.369	0.262
EMCR	---	1.000	0.615	0.650	0.441	0.429	0.441	0.437	0.317	0.317	0.317	0.303	0.303	0.239
229E	---	---	1.000	0.557	0.380	0.365	0.376	0.380	0.321	0.313	0.313	0.303	0.320	0.269
PEDV	---	---	---	1.000	0.460	0.452	0.425	0.460	0.351	0.360	0.364	0.358	0.363	0.234
TGEV	---	---	---	---	1.000	0.878	0.836	0.958	0.330	0.334	0.346	0.335	0.332	0.208
CaCoV	---	---	---	---	---	1.000	0.835	0.878	0.311	0.315	0.326	0.319	0.304	0.192
FeCoV	---	---	---	---	---	---	1.000	0.851	0.296	0.307	0.315	0.300	0.292	0.192
PRCoV	---	---	---	---	---	---	---	1.000	0.330	0.334	0.346	0.335	0.332	0.215
OC43	---	---	---	---	---	---	---	---	1.000	0.934	0.947	0.848	0.818	0.270
PHEV	---	---	---	---	---	---	---	---	---	1.000	0.943	0.848	0.818	0.270
BoCoV	---	---	---	---	---	---	---	---	---	---	1.000	0.870	0.839	0.278
MHV	---	---	---	---	---	---	---	---	---	---	---	1.000	0.938	0.271
RatSA	---	---	---	---	---	---	---	---	---	---	---	---	1.000	0.275
AIBV	---	---	---	---	---	---	---	---	---	---	---	---	---	1.000

Fig. 3i: Matrix nucleotide identity

Seq->	EMCR	229E	PEDV	TGEV	FeCoV	PRCoV	CaCoV	RSDAC	MHV	PHEV	OC43	BoCoV	SARS	AIBV
EMCR	1.000	0.447	0.358	0.336	0.326	0.334	0.344	0.188	0.189	0.179	0.183	0.183	0.210	0.173
229E	---	1.000	0.336	0.535	0.304	0.328	0.333	0.196	0.204	0.187	0.190	0.188	0.199	0.173
PEDV	---	---	1.000	0.277	0.244	0.272	0.270	0.163	0.168	0.160	0.160	0.158	0.184	0.178
TGEV	---	---	---	1.000	0.761	0.963	0.897	0.220	0.223	0.200	0.202	0.200	0.232	0.192
FeCoV	---	---	---	---	1.000	0.756	0.763	0.209	0.212	0.185	0.187	0.189	0.218	0.185
PRCoV	---	---	---	---	---	1.000	0.879	0.220	0.228	0.202	0.204	0.202	0.230	0.192
CaCoV	---	---	---	---	---	---	1.000	0.215	0.221	0.196	0.198	0.196	0.216	0.196
RSDAC	---	---	---	---	---	---	---	1.000	0.894	0.693	0.697	0.697	0.285	0.200
MHV	---	---	---	---	---	---	---	---	1.000	0.680	0.684	0.682	0.282	0.208
PHEV	---	---	---	---	---	---	---	---	---	1.000	0.948	0.953	0.261	0.195
OC43	---	---	---	---	---	---	---	---	---	---	1.000	0.973	0.261	0.197
BoCoV	---	---	---	---	---	---	---	---	---	---	---	1.000	0.266	0.197
SARS	---	---	---	---	---	---	---	---	---	---	---	---	1.000	0.211
AIBV	---	---	---	---	---	---	---	---	---	---	---	---	---	1.000

TTTATGGCTCCTGTTATGATATTTTCTTTGTTGGCAATGACCTTTATTAAGTCAATTGTGTTTACTTGTCAATTATTTTTT
AAAATACCGAGGAACAATACTATAAAAGAAACACAACCGTTACTGGAAATAATTTGACTAAGTTAACACAAAATGAACAGTAATAAAAAA 25300
I L W L L V M I F F F V L A M T F I K L I O L C F T C H Y F F
E

AGTAGGACATTATATCAACCAGTTTATAAAATTTTCTTGCTTACCAAGATTATATGCAAATAGCACCTGTTCCAGCTGAAGTACTAAATGT
TCATCCTGTAATATAGTTGGTCAAATATTTAAAAAGAACGAATGGTCTAATATACGTTTATCGTGGACAAGGTCGACCTCATGATTTACA 25392
S R T L Y O P V Y K I F L A Y O D Y M O I A P V P A E V L N V
E

CTAAACTAAACGATGCTAATAGTAGTGTGCTCTTTAGAGGTTTATGTCCATTTACGTAAGTGAACCTTTAGTTGGAATTTAATCTAAC
GATTGATTTGCTACAGATTATCATCACCGGAGAAAGTCTCCAAATACAGGTAATGCATTGACCTTGAAATCAACCTTAAATTAAGATTG 25484
-E- M S N S S V P L S E V Y V H L R N W N F S W N L I L T
M

AGTTTTATAGTTGTGTGCGATATGGGCATTATAAGTATAGCAGACTTCTTTATGGTTTAAAGATGTCTGTTTATGGTGTATGGCCAC
TCAAAAATATCAACACAACGTCATACCCGTAATATTCATATCGTCTGAAGAAATACCAAATTTCTACAGACAAAATACCACAAATACCGGTG 25576
V F I V V L O Y G H Y K Y S R L L Y G L K M S V L W C L W P
M

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AACAAGATCGAAACAGATAAAACTGACAAAACAGTTAAATACACCTGACCCAGAAAAACCAAAATCATAAGAATACAGATAAATGT 25668
L V L A L S I F D C F V N F N V D W V F F G F S I L M S I I T
M

CTTTGTTTATGGGTTATGTTTGTAAATAGTTTCAAGCTTTGGCGCGGTGTTAAACTTTTTGGGCTTTTAACTCTGAACTAATGCAAT
GAAACAAATACCAATACATAAAACAATTATCAAAGTCTGAAACCGCGGCACAAATTTGAAAAACCGAAATAGGACTTTGATTACGTTA 25760
L C L W V M Y F V N S F R L W R R V K T F W A F N P E T N A I
M

CATCTCTCTCCAGGTTTATGGACATAATTATTACTTACCGGTGATGGCTGCACCTACAGGTGTACATTAACTTCTTAGTGGTGTACTTC
GTAGAGAGAGGTCCAATACCTGTATTAATAATGAATGGCCACTACCGAGTGGATGTCCACAATGTAATTGTGAAGAATCACCACATGAAG 25852
I S L O V Y G H N Y Y L P V H A A P T G V T L T L L S G V L
M

TTGTTGATGGCCATAAGATTGCTACTCGTGTCAAGTGGGTCAGTTGCCTAAATATGTAATAGTTGCTACACCTAGTACCACAATTGTTGT
AACAACCTACCGGTATTCTAACGATGAGCACAAGTTCACCCAGTCAACGGATTTATACATTATCAACGATGTGGATCATGGTGTAAACAACA 25944
L V D G H K I A T R V O V G O L P K Y V I V A T P S T T I V C
M

GACCGTGTGGTCTGCTCTGTTAATGAAACAAGCCAGACTGGTTGGGCATTCTACGTCCTGCTAAACATGGTGATTTTCTGGTGTGCTCTC
CTGGCACAACCGAGGAGACAATTACTTTGTTGGTCTGACCAACCCGTAAGATGCAGGCAGGATTGTACCACTAAAAAGACCACAACGGAG 26036
D R V G R S V N E T S O T G W A F Y V R A K H G D F S G V A S
M

TCAGGAGGGTGTGTTGTCAGAAAGAGAGAAGTTGCTTCATTTAATCTAACTAAACAAAATGGCTAGTGTAATTGGGCCGATGACAGAGCT
AGTCCTCCCAAAAACAGTCTTTCTCTCTTCAACGAAGTAAATTAGATTGATTGTTTTACCGATCACATTTAACCCGGCTACTGTCTCGA 26128

Q E G V L S E R E K L L H L I . M A S V N W A D D R A
M N

GCTAGGAAGAAATTTCTCTCTCTTCATTTTACATGCCTCTTTGGTTAGTTCTGATAAGGCACCATATAGGCTCATTCCAGGAATCTTGT
CGATCCTTCTTTAAAGGAGGAGGAAGTAAATGTACGGAGAAAACCAATCAAGACTATTCGGTGTATATCCAGTAAGGGTCTTAGAACA 26220

A R K K F P P P S F Y M P L L V S S D K A P Y R V I P R N L V
N

CCCTATTGGTAAGGGTAATAAAGATGAGCAGATTGGTTATTGGAATGTTCAAGAGCGTTGGCGTATGCGCAGGGGGCAACGTGTTGATTTC
GGGAATCACTATCCATTATTTCTACTCGTCTAACCAATAACCTTACAAGTCTCGCAACCGCATACGGTCCCCGTTGCACAATAAACG 26312

P I G K G N K D E D I G Y W N V Q E R W R H R R G O R V D L
N

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GAGGATTTCAAGTAAAAATAATGGATCCATGACCTGGAGTATTCCTGGAATTTAAGTCTGTTGCAAGACTACCACAACAAACCAACGATTC 26404

P P K V H F Y Y L G T G P H K D L K F R O R S D G V V W V A K
N

GAAGGTGCTAAACTGTTAATACCAGTCTTGGTAATCGAAACGTAATCAGAAACCTTTGGAACCAAAGTCTCTATTGCTTTGCCTCCAGA
CTTCCACGATTTTGACAATTATGGTCAGAACCATAGCGTTTGCAATAGTCTTTGGAACCTTGGTTTCAAGAGATAACGAAACGGAGGTCT 26496

E G A K T V N T S L G N R K R N O K P L E P K F S I A L P P E
N

GCTCTGTGTGTTGAGTTTGAGGATCGCTCTAATAACTCATCTCGTGCTAGCAGTCTTETTCAACTCGTAACAACTCACGAGACTCTTCTC
CGAGAGACAACAACTCAAACCTCTAGCGAGATTATTGAGTAGAGCAGCATGTCAGCAAGAAGTTGAGCATTGTTGAGTGCTCTGAGAAGAG 26588

L S V V E F E D R S N N S S R A S S R S S T R N N S R D S S
N

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CATCATGAAGTTCTGTTGTCAGAGCGTGAGCAAGACTAAGATTGGTCAGAAGAAGTCTAGAACAACGACGACAATGAAACCGAAATTTCTTG 26680

R S T S R O O S R T R S D S N O S S S D L V A A V T L A L K N
N

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AATCCAAAACCTATTGGTCAGCTTCAGTGGATCAAGAAGACCATGAAGGTGAGGATTCTTTGGATTATTCGGAGAAAGAGTTGGGTCCTCGACT 26772

L G F D N O S K S P S S S G T S T P K K P N K P L S O P R A D
N

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ATTCGAAGAGTCAACTTCTTTGGAGCAACCTTCGCACAAGGATGGTCTCTCTTTTACAATAAGTCACGAAACAGGAGCACTAAAATTAG 26864

K P S O L K K P R W K R V P T R E E N V I O C F G P R D F N
N

ACAATATGGGGATTTCAGATCTTGTTCAGAATGGTGTGATGCCAAGGGTTTCCACAGCTTGCTGAATTGATTCTAATCAGGCTGCGTTA
TGTATACCCCTAAGTCTAGAACAAAGTCTTACCACAACACGGTTCCTCCAAAAGGTGTCGAACGACTTAACCTAAGGATTAGTCCGACGCAAT 26956

H N M G D S D L V O N G V D A K G F P O L A E L I P N Q A A L
N

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AAGAACTATCACTCCAATCGTGACTACTTCACCCACTATTACAAGTCTAATGGATGTGGATGTTTACGAACATCGATTCTATTATTCTT 27048

F F D S E V S T D E V G D N V Q I T Y T Y K M L V A K D N K N
N

CCTTCCTAAGTTCATTGAGCAGATTAGTGCTTTTACTAAACCCAGTTCTATCAAGAAATGCAGTCACAATCATCTCATGTTGCTCAGAACA
GGAAGGATTCAAGTAACTCGTCTAATCACGAAATGATTGGGTCAAGATAGTTTCFTTACGTCAGTGTTAGTAGAGTACAACGAGTCTTGT 27140

L P K F I E Q I S A F T K P S S I K E H O S O S S H V A O N
N

CAGTACTTAATGCTTCTATTCCAGAATCTAAACCATGGCTGATGATGATTCAGCCATTATAGAAATGTCAACGAGGTTTTGCATTAATT
GTCATGAATTACGAAGATAAGGCTCTAGATTGGTAACCGACTACTACTAAGTCGGTAATATCTTTAACAGTTGCTCCAAAACGTAATTTAA 27232

T V L N A S I P E S K P L A D D D S A I I E I V N E V L H . 3'
N

GTTTTGAATTCAGTTGAATGTTTATTATTATTAGTTGCAACCCCATGCGTTTAGCGCATGATAAGGGTTTAGTCTTACACACAATGGTAG
CAAAACATTAAAGTCAACTTACAAATAATAATAATCAACGTTGGGTACGCAATCGCGTACTATTCCCAAATCAGAATGTGTGTACCATC 27324

3'UTR

GCCAGTGATAGTAAAGTGAAGTAATTTGCTATCATATTAACATGTCTAGAGGAAAGTCAGAACTTTTCTGTTTGTGTTGGAGTACTT
CGGTCATATCATTTACATTCTTAACGATAGTATAATTGTACAGATCTCCTTTCAGTCTTGAAAAAGACAAACACAACCAACCTCATGAA 27416

3'UTR

AAAGATCGCATAGGCGGCCAACAAATGGAAGAGCCAACAACATATCTAAAAATGTTTGTCTGGTACTTGTTAATGATATTGTTTTGATAT
TTTCTAGCGTATCCGCGCGGTTGTACCTTCTCGGTTGTGTATAGATTTTACAAAACAGACCATGAACAATTACTATAACAAAACTATA 27508

3'UTR

GGATACACAAAAAAAAAAAAA
CCTATGTGTTTTTTTTTTTTTTT 27532

3'UTR

Fig. 2A

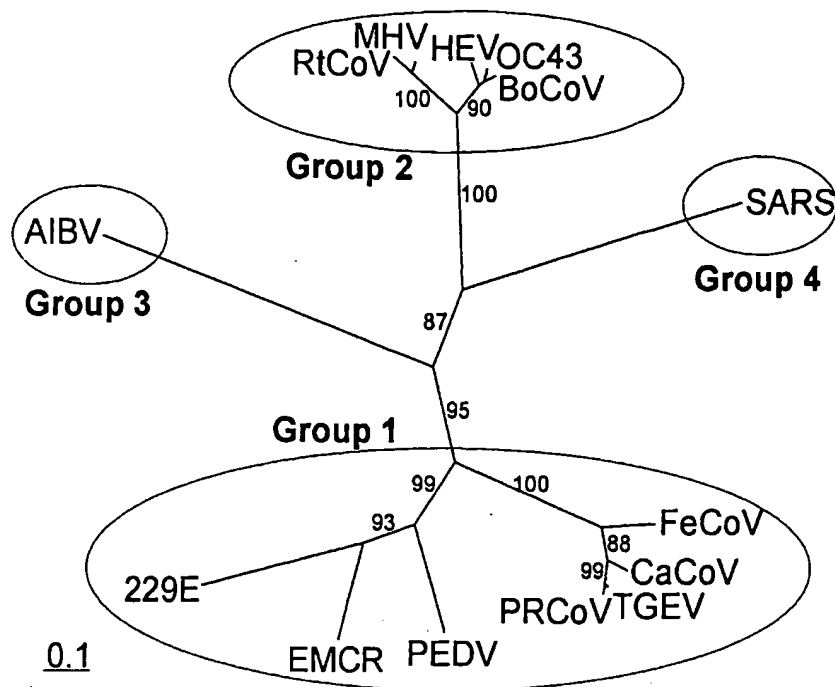


Fig. 2B

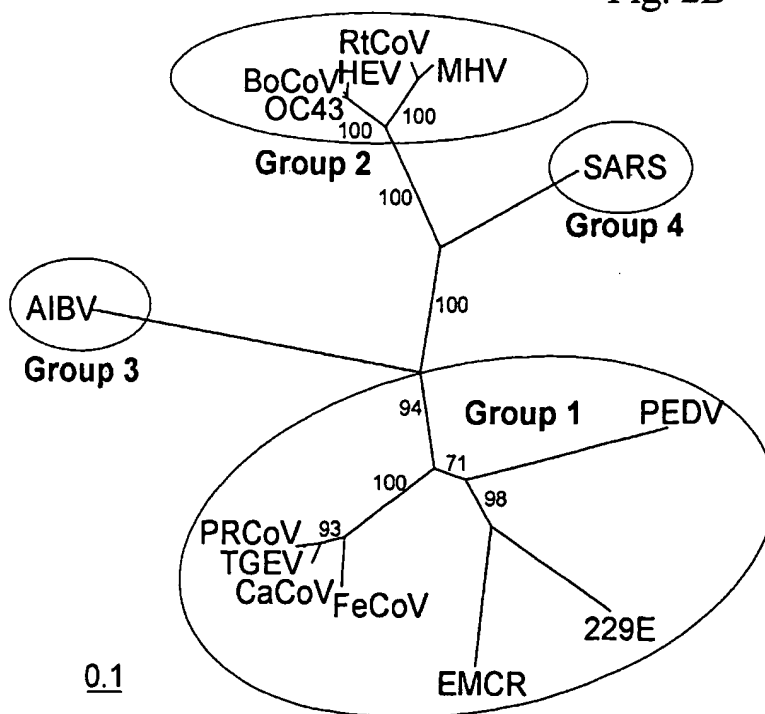


Fig. 3a: Putative Orf 1a Amino acid identity matrix

Seq->	EMCR	229E	PEDV	TGEV	OC43	BoCoV	MHV	AIPV	SARS
EMCR	1.000	0.566	0.491	0.371	0.211	0.213	0.215	0.185	0.194
229E	---	1.000	0.475	0.379	0.211	0.211	0.209	0.191	0.194
PEDV	---	---	1.000	0.366	0.208	0.208	0.204	0.183	0.192
TGEV	---	---	---	1.000	0.204	0.204	0.199	0.182	0.186
OC43	---	---	---	---	1.000	0.964	0.656	0.182	0.255
BoCoV	---	---	---	---	---	1.000	0.659	0.186	0.255
MHV	---	---	---	---	---	---	1.000	0.178	0.253
AIPV	---	---	---	---	---	---	---	1.000	0.178
SARS	---	---	---	---	---	---	---	---	1.000

Fig. 3b: Putative Orf 1b Amino acid identity matrix

Seq->	EMCR	229E	PEDV	TGEV	BoCoV	OC43	MHV	AIPV	SARS
EMCR	1.000	0.815	0.778	0.711	0.504	0.517	0.523	0.516	0.550
229E	---	1.000	0.765	0.720	0.504	0.520	0.515	0.515	0.546
PEDV	---	---	1.000	0.728	0.522	0.538	0.531	0.523	0.552
TGEV	---	---	---	1.000	0.517	0.533	0.529	0.520	0.551
BoCoV	---	---	---	---	1.000	0.953	0.832	0.519	0.591
OC43	---	---	---	---	---	1.000	0.857	0.534	0.611
MHV	---	---	---	---	---	---	1.000	0.532	0.606
AIPV	---	---	---	---	---	---	---	1.000	0.541
SARS	---	---	---	---	---	---	---	---	1.000

Fig. 3c: Putative Orf 1ab Amino acid identity matrix

Seq->	EMCR	229E	PEDV	TGEV	OV43	BoCoV	MHV	AIBV	SARS
EMCR	1.000	0.666	0.605	0.503	0.314	0.310	0.316	0.314	0.326
229E	---	1.000	0.592	0.510	0.320	0.314	0.316	0.311	0.326
PEDV	---	---	1.000	0.509	0.326	0.320	0.323	0.313	0.328
TGEV	---	---	---	1.000	0.317	0.311	0.313	0.311	0.320
OV43	---	---	---	---	1.000	0.961	0.734	0.312	0.408
BoCoV	---	---	---	---	---	1.000	0.725	0.307	0.400
MHV	---	---	---	---	---	---	1.000	0.309	0.404
AIBV	---	---	---	---	---	---	---	1.000	0.312
SARS	---	---	---	---	---	---	---	---	1.000

Fig. 3d: Putative Spike protein Amino acid identity matrix

Seq->	EMCR	229E	PEDV	TGEV	CaCoV	FeCoV	Por R	OC43	BoCoV	MHV	Rat C	PHEV	AIBV	SARS
EMCR	1.000	0.547	0.442	0.387	0.386	0.394	0.393	0.205	0.206	0.196	0.198	0.203	0.202	0.167
229E	---	1.000	0.412	0.383	0.381	0.383	0.445	0.178	0.185	0.178	0.174	0.179	0.230	0.176
PEDV	---	---	1.000	0.412	0.412	0.415	0.403	0.193	0.188	0.189	0.189	0.194	0.198	0.179
TGEV	---	---	---	1.000	0.787	0.802	0.812	0.196	0.195	0.199	0.202	0.197	0.188	0.171
CaCoV	---	---	---	---	1.000	0.911	0.743	0.196	0.195	0.202	0.202	0.194	0.184	0.167
FeCoV	---	---	---	---	---	1.000	0.758	0.195	0.193	0.197	0.200	0.196	0.188	0.167
Por R	---	---	---	---	---	---	1.000	0.183	0.185	0.189	0.191	0.186	0.212	0.164
OC43	---	---	---	---	---	---	---	1.000	0.911	0.637	0.637	0.803	0.171	0.254
BoCoV	---	---	---	---	---	---	---	---	1.000	0.642	0.643	0.817	0.173	0.255
MHV	---	---	---	---	---	---	---	---	---	1.000	0.909	0.643	0.183	0.249
Rat C	---	---	---	---	---	---	---	---	---	---	1.000	0.646	0.184	0.255
PHEV	---	---	---	---	---	---	---	---	---	---	---	1.000	0.177	0.252
AIBV	---	---	---	---	---	---	---	---	---	---	---	---	1.000	0.164
SARS	---	---	---	---	---	---	---	---	---	---	---	---	---	1.000

Fig. 3e: Putative OrfE Amino acid identity matrix

Seq->	EMCR	229E	PEDV	TGEV	CaCoV	FeCoV	Por R	OC43	BoCoV	PHEV	MHV	Rat C	AIBV	SARS
EMCR	1.000	0.467	0.415	0.292	0.304	0.256	0.304	0.154	0.154	0.154	0.181	0.181	0.092	0.179
229E	---	1.000	0.532	0.243	0.231	0.243	0.231	0.214	0.214	0.214	0.227	0.227	0.120	0.230
PEDV	---	---	1.000	0.280	0.268	0.256	0.280	0.214	0.214	0.214	0.227	0.227	0.092	0.179
TGEV	---	---	---	1.000	0.914	0.743	0.963	0.172	0.172	0.172	0.172	0.172	0.145	0.228
CaCoV	---	---	---	---	1.000	0.804	0.926	0.172	0.172	0.172	0.193	0.193	0.127	0.216
FeCoV	---	---	---	---	---	1.000	0.756	0.183	0.183	0.183	0.182	0.182	0.127	0.204
Por R	---	---	---	---	---	---	1.000	0.183	0.183	0.183	0.172	0.172	0.136	0.216
OC43	---	---	---	---	---	---	---	1.000	0.976	0.988	0.644	0.655	0.119	0.176
BoCoV	---	---	---	---	---	---	---	---	1.000	0.988	0.622	0.633	0.110	0.176
PHEV	---	---	---	---	---	---	---	---	---	1.000	0.633	0.644	0.119	0.176
MHV	---	---	---	---	---	---	---	---	---	---	1.000	0.977	0.128	0.191
Rat C	---	---	---	---	---	---	---	---	---	---	---	1.000	0.128	0.202
AIBV	---	---	---	---	---	---	---	---	---	---	---	---	1.000	0.137
SARS	---	---	---	---	---	---	---	---	---	---	---	---	---	1.000

Fig. 4 Alignments

a. 5' untranslated region (Genomic sequence) aligned with human coronavirus 229E

	5 15 25 35 45 55
EMCR5'UTR	-----AGATAGA GAATTTTCTT ATTTAGACTT TGTGTCTACT
229E5'UTR	ACTTAAGTAC CTTATCTATC TACAGATAGA AAAGTTGCTT -TTTAGACTT TGTGTCTACT

	65 75 85 95 105 115
EMCR5'UTR	CCTCTCAACT AAACGAAATT TTT-CTAGTG CTGTCAATTG TTATG--GCA GTCCTAGTGT
229E5'UTR	TTTCTCAACT AAACGAAATT TTTGCTATGG CCGGCATCTT TGATGCTGGA GTCGTAAGTGT

	125 135 145 155 165 175
EMCR5'UTR	AATTGAAATT TCGTCAAGTT TGTAA-ACTG GTTAGGCAAG TGTTGTATTT TCTGTGTTTA
229E5'UTR	AATTGAAATT TCATTGGGT TGCAACAGTT TGAAGCAAG TGCTGTGTGT CCTA-GTCTA

	185 195 205 215 225 235
EMCR5'UTR	AGCACTGGTG GTTCTGTC-C ACTAGTGCAC AC-ATTGATA CTTAAGT-GG TGTCTGTCA
229E5'UTR	AGGGTTTCGT GTTCCGTCAC GAGATTCAT TCTACAAACG CCTTACTCGA GGTTCGCTCT

	245 255 265 275 285
EMCR5'UTR	CTGCTTATTG TGGAAGCAAC GTTCTGTCGT TGTGGAAACC AATAACTGCT AACC
229E5'UTR	CGTGTGTTG TGGAAGCAAA GTTCTGTCTT TGTGGAAACC AGTAACGTGT CCTA

b. Putative Orf 1a

	5 15 25 35 45 55
EMCR	-----MFYNQVT LAVASDSEIS GFGFAIPSPA VRAYSEAAQ GFQACRFVAF
229E	-----MACNRVT LAVASDSEIS ANGCSIAQA VRRYSEAAAS GFRACRFVSL
PEDV	-----MASNHVT LAFANDAEIS AFGFCTASEA VSYSEAAAS GFMQCRFVSL
TGEV	-----MSSKQFK ILVNEDYQVN VPSLPIR-DV LQETKYCYRN GFEGYVFVPE
OC43	MSKINKYGLE LHWAEFFPWW FEDAEKLDN PSSSEVDMIC STTAQKLETD GICPENHVMV
BoCoV	MSKINKYGLE LHWAEFFPWW FEDAEKLDN PSSSEVDIVC STTAQKLETD GICPENHVMV
MHV	MAKMGKYGLE LHWAEFFPWW LPNASEKLGS PERSEEDGFC PSAAQEPKTK GKTILNHVRV
AIPV	-----MASSLKQ GVSPKPRDVI LVSKDIPEQL CDALFFYTSH NPKDYADAF
SARS CoV	-----MESLVLG VNEKTHVQLS LPVLQVRDVL VRGFGDSVEE ALSEAREHLK

	65 75 85 95 105 115
EMCR	GLQDCVTGIN DDD-YVIALT GTNQLCAKIL LFSDRPLNLR GWLIFSNSNY VLQDFDVVFG
229E	DLQDCIVGIA DDT-YVMGLH GNQTLFCNIM KFSDRPFMLH GWLVFSNSNY LLEEFDVVFG
PEDV	DLADTVEGLL PED-YVMVVI GTTKLSAYVD TFGSRPRNIC GWLLFSNCNY FLEELELTFG
TGEV	YCRDLVDCDR KDH-YVIGVL GNGVSDLKPV LLTEPSVMLQ GFIVRANCNG VLEDFDLKIA
OC43	DCRRLLKQEC CVQSSLIREE VMNASPYDLE VLLQDALQSR EAVLVTTPLG MSLEACYVRG
BoCoV	DCRRLLKQEC CVQSSLIREE VMNTRPYDLE VLLQDALQSR EAVLVTPPLG MSLEACYVRG
MHV	DCSRLPALEC CVQSAIIRDI FVDEDPLNVE ASTMMALQFG SAVLVKPSKR LSIQAWAKLG
AIPV	VRQKFDRSLQ TGKQFKFETV CGFLFLKGVD KITPG----- VPAKVLKATS KLADLEDIFG
SARS CoV	NGTCGLVELE KGVLPQLEQP YVFIKRS DAL STNHGHKVVE LVAEMDGIQY GRSGITLGV

	125 135 145 155 165 175
EMCR	--HGAGSVVF VDKYMGCFDG KPVLPKNMWE FRDYFENDNTD S-IVIGGVTY QLAWDVIRKO
229E	K-RGGGNVTY TDQYLCGADG KPVMSIEDLMQ FVDHFEENEE --IIINGHTY VCAWLTKRKP
PEDV	--RRGGNIYP VQYMGADG KPVQSESEWE YTDFFADSED GQLNIAGITY VKAWIVERSD
TGEV	--RTGRGAIY VQYMGADG KPVIEG---D FKDYFGDED- --IIEFEGEY HCWTTVRDE
OC43	C-NPRGWTMG LFRRRSVCNT GRCTVNKHVA YQLYMIDPAG ---VCLGAGO FVGWVIPLAF
BoCoV	C-NPNGWTMG LFRRRSVCNT GRCAVNKHVA YQLYMIDPAG ---VCFGAGQ FVGWVIPLAF
MHV	V-LPKTPAMG LFKRFCLCNT RECVCDAHVA FQLFTVQPDG ---VCLGNR FIGWFVPVTA
AIPV	VSPLARKYRE LLKTACQWSL TVEALDVRAQ TLDEIFDPT- ----- EILWLQVAAK
SARS CoV	VPHVGETPIA YRNVLRLKNG NKGAGGHSYG IDLKSVDLGD ELGTDPIEDY EQNWNTRKHS

	185	195	205	215	225	235
EMCR	LSYEQQNVLA	IESIHVLTG-T	TGHTLKSCK	LINAKPPKY-	--SSKVVLSG	EWNAVYKAFG
229E	LDYKQNNLA	IEEIEYVHGD	ALHTLRNGSV	LEMAKEVKT-	--SSKVVLSG	ALDKLYKVFG
PEDV	VSYASQNLTS	IKSITYCS-T	YEHTFLDGT	MKVARTPKI-	--KKNVVLSE	PLATIYREIG
TGEV	KPLNQOTLFT	IQEIQYNL-D	IPHKLPNCAT	RHVAPPVKK-	--NSKIVLSE	DYKKLYDIFG
OC43	MPVQSRKFIV	PWVMYLRKRG	EKGAYNKDHG	RGGFH----	--VYDFKVED	AYDQVHDEPK
BoCoV	MPVQSRKFIA	PWVMYLRKCG	EKGAYIKDYK	RGGFH----	--VYNFKVED	AYDLVHDEPK
MHV	IPAYAKQWLQ	PWSILLRKGG	NKGSVTSGHF	RRAVTMP----	--VYDFNVED	ACEEVHLNPK
AIPV	IHVSSMAMRR	LVGEVTAKVM	DALGSNLSAL	FQIVKQ----	--QIARIFQK	ALAIFFENVNE
SARS CoV	GALRELTREL	NGGAVTRYVD	NNECGPDGYP	LDCIKDFLAR	AGKSMCTLSE	QLDYIESKRG

	245	255	265	275	285	295
EMCR	SPFITNGISL	LDIIVKPVFF	NAFVKCNCGS	ENWSVGAWDG	YLSGCCGTPA	KKLCVVPGNV
229E	SPVMTNGSNI	LEAFTKPVFI	SALVQCTCGT	KSWSVGDWTG	FKSSCCNVIS	NKLCVVPGNV
PEDV	SPFVDNGSDA	RSIIRPVFL	HAFVKCKCGS	YHWTGVDWTS	YVSTCCGFKC	KPVLVASCSSA
TGEV	SPFMNGDCL	SKCFDTLHFI	AATLRCPGCS	ESSGVGDWTG	FKTACCGLSG	KVKGVLGDI
OC43	GKFSKKAYAL	IRGYRGVKPL	LYVDQYGCDD	TGSLADGLEA	YADKTLOEMK	ALFPTWSQEL
BoCoV	GKFSKKAYAL	IRGYRGVKPL	LYVDQYGCDD	TGSLADGLEA	YADKTLOEMK	ALFPTWSQEL
MHV	GKYSKKAYAL	LKGYRGVKS	LFLDQYGCDD	TGRLAKGLED	YGDCTLEEMK	ELFPVWCDSL
AIPV	LPQRIAAALKM	AFAKCARSIT	VVVVERTLVV	KEFAGTCLAS	INGAVAKFFE	ELPNGFMGSK
SARS CoV	VYCCRDHEHE	IAWFTERSDK	SYEHQTPFEI	KS--AKKFD	FKGECPKFVF	PLNSKVVKVIQ

	305	315	325	335	345	355
EMCR	VPGDVIITST	DAGCGVXYA	GLVVKHITNI	TGVSLWRVTA	VHSDGMFVAT	SSYDALLHRN
229E	KPGDAVITTO	QAGAGIRYFC	GMTLKEVANI	EGSVVWRVIA	LQSVDCFVAS	STFEVEEHVN
PEDV	MPGSVVVTRA	GAGTGKYYN	NMFLRHVADI	DGLAFWRILK	VQSKDDLACS	GKFLHHEEG
TGEV	KPGDAVITSM	SAGKGVKFFA	NCVLQYAGDV	EGSVIWKVIA	TFTVDETVC	PGFEGELN--
OC43	LFDVIVAWHV	VRDP----RY	VMRLQSAATI	R---SVAYVA	NPTEDLDCGS	VVIKEPVHVV
BoCoV	PFDVTVAHV	VRDP----RY	VMRLQSAATI	R---SVAYVA	NPTEDLDCGS	VVIKEPVHVV
MHV	DNEVVVAHV	DRDP----RA	VMRLQTLATI	R---SIGYVG	QPTEDLVGDG	VVVREPAHLL
AIPV	IFTTLAFKE	AAVR-----	-VVENIPNAP	RGTKGFVEVG	NAKGTQVVVR	GMRNDLTLLD
SARS CoV	PRVEKKKTEG	FMGRIRSVYP	VASPEQCENM	HLSTLMKCNH	CDEVSWQTC	FLKATCEHCG

	365	375	385	395	405	415
EMCR	SLDPFCFDVN	TLLSNQLRLA	FLGASVTEVD	KFAASTGVID	ISAGMFLGYD	DILTNNKPWF
229E	RMDTFCFNVR	NSVTDECLA	MLGAEMTSNV	RRQVAGSVID	ISTGWDFVVD	DIFAESKPWF
PEDV	FTDPCYFLND	SSLATKLKFD	ILSGKFSDEV	KQAIAGHVV	VGSALVDIVD	DALG--QPWF
TGEV	--DFIKPESK	SLVACSVKRA	FITGDIDDAV	HDCIITGKLD	LSTNLFNGVG	LLFKK--TPWF
OC43	ADDSIILRQY	NLVDIMSHFY	MEADTVVNAF	YGVALKDCGF	VMQFGYIDCE	QDSCDFKGWI
BoCoV	ADDSIILRQH	NLVDIMSCFY	MEADAVVNAF	YGVOLKDCGF	VMQFGYIDCE	QDLCDFKGWV
MHV	AAANAIVKRLP	RLVETMLYT-	--DSSVTEFC	YKTKLDCDGF	ITQFGYVDC	GDACDFRGWV
AIPV	QKADIPVEPE	GWSAILDGH	CYVFRSGDRF	YAAPLSGNFA	LSDVHCCEV	VCLSDGVTPPE
SARS CoV	-TENLVIEGP	TTCGYLPTNA	VVMPCPCACQ	DPEIGPEHSV	ADYHNHNSIE	TLRL--KGG

	425	435	445	455	465	475
EMCR	VRKASGLFDA	IWDAFVAIAK	LVPTTTGGLV	RFVKSIASTV	LTVSNGVIIM	CADVPAFQF
229E	VRKAEDIFGP	CWSALASALK	QLKVTTGELV	RFVKSICNSA	VAVVGTTIQI	LASVPEKFLN
PEDV	IRKLGDLASA	PWEQLKAVVR	GLGLLSDEVV	LFGKRLSCAT	LSIVNGVFEF	LADVPEKLAA
TGEV	VQKCGALFVD	AWKVVEELCG	SLTLTYKQIY	EVVASLCTSA	FTIVNYKPTF	VVPD--NRVKD
OC43	PGNMIDGFAC	TTCGHVYEVG	DLIAQSSGVL	PVNPVLHTKS	AAGYGG----	-FGCKDSFTL
BoCoV	PGNMIDGFAC	TTCGHVYETG	DLIAQSSGVL	PVNPVLHTKS	AAGYGG----	-FGCKDSFTL
MHV	PGNMMDGFLC	PGCSKSYMPW	ELEAQSSGVI	PKGGVLTQTS	TDTVN-----	---RESFKL
AIPV	INDGLILAAI	YSSFSVSELV	TALKKGEPEK	FLGHKFEVYK	DAAVS-----	---FTL
SARS CoV	TRCEGGCVFA	YVGCYNKRAY	WVPRASADIG	SGHTGITGON	VETLN-----	---EDLLEILS

	485	495	505	515	525	535
EMCR	VYRTFTQAIC	AAFDFSLDVF	KIG---DVKF	KRLGDYVLTE	NALVRLTTEV	VRGVDRARIK
229E	AFDVFVTAIQ	TVFDCAVETC	TIA---GKAF	DKVFDYVLLD	NALVKLVTTK	LKGVREERGLN
PEDV	AVTVFVFNLM	EFFESACDCL	KVG---GKTF	NKGVSYVLFD	NALVKLVRAK	ARGPROAGIC
TGEV	LVDKCVKVLV	KAFDVFTQII	TIAGIEAKCF	VLGAKYLLFN	NALVKLVSVK	ILGKKQKGLE
OC43	YGQTVVYFVG	CVYWSPARNI	WIP---ILKSS	VKSYSYDLVY	GVLGCKAIVK	ETNLICKALY
BoCoV	YGQTVVYFVG	CVYWSPARNI	WIP---ILKSS	VKSYSYDLVY	GVVGCKAIVK	ETNLICKALY
MHV	YGHAVVPFGS	AVYWSPPYGM	WLP---VIWSS	VKSYSADLT	GVVGCKAIVQ	ETDAICRSIY
AIPV	AKAATIADVL	RLFQSARVIA	EDVWS-SFTE	KSEFEWKLAY	GKVRNLEEFV	KTYVCKAQMS
SARS CoV	RERVNINIVG	DFHLNEEVAI	ILAS-FSAST	SAFIDITKSL	DYKSFKTIVE	SCGNKYVTGK

	545	555	565	575	585	595
EMCR	KAMFTKVVVG	PTTEVKFSVI	ELATVNLRLV	DCAPVVCPRG	KIVVIAGQAF	FYSGGFYRFM
229E	KVKYATVVVG	STEEVKSSRV	ERSTAVLTIA	NNYSKLFDEG	YTVVIGDVA	FVSDGYFRML
PEDV	EVRYTSLVVG	STTKVVSXRV	ENANVNVLVV	DEDVTLNTTG	RTVVVDGLAF	FESDGYFRHL
TGEV	CAFFATSLVG	ATVNVTPKRT	ETATISLNVK	DDVVAPG-EG	YIVIVGDMAF	YKSGEYFMM
OC43	LDYVQHKCGN	LHQRELLGVS	DVWHKQLLLN	RGVYKPLLEN	IDYFNMRRAK	FSLETFTVCA
BoCoV	LDYVQHKCGN	LHQRELLGVS	DVWHKQLLLN	RGVYKPLLEN	IDYFNMRRAK	FSLETFTVCA
MHV	MDYVQHKCGN	LEQRAILGLD	DVYHRLQLLN	RGDYSLLLEN	VDLFVKRRAE	FACK-FATCG
AIPV	IVILAAVLGE	DIWHLVSQVI	YKLGVLFTKV	VDFCDKHWKG	FCVQLKRAKL	IVTETFCVLK
SARS CoV	KPVKGAWNIG	QQRSVLTPLC	GFPSQAAGVI	RSIFARTLDA	ANHSIPDLQR	AAVTILDGTS

	605	615	625	635	645	655
EMCR	VDSSTVLNDP	VFTGELFYTI	KFSGFKLDGF	N-----H	QFVNASSATD	AIIAVELLS
229E	ASPNVSLTTA	VYKPLFAFNV	NVMGTRPE--	-----	KFPTTVCEN	LESALFVND
PEDV	ADADVIEHP	VYKSACELKP	VFECDPIP--	D-----F	PLPVAASVAE	LCVQTDLLK
TGEV	SSPNFVLTNN	VFKAVKVPST	DIVYDVNDT	KSKMIAKLGS	SFEYDGDIDA	AIVKVNELLI
OC43	DGFMFLLDD	LVPRAYYLAV	SGQAFCDY--	-----	ADKLCHAVVS	KSKELLDVSL
BoCoV	DGFMFLLDD	LVPRAYYLAV	SGQAFCDY--	-----	AGKICHAVVS	KSKELLDVSV
MHV	DGLVPLLLDG	LVPRSYLLIK	SGQAFTSM--	-----	MVNFSEHTD	MCMDMLLFM
AIPV	GVAQHCFQLL	LDIAHSLYKS	FKKCALGR--	-----	---IHGDLF	WKGGVHKKIV
SARS CoV	EQSLRLVDM	VYTSDLLTNS	VIIMAYVTG-	-----	---GLVQQTQ	WLSNLLGTTV
	665	675	685	695	705	715
EMCR	DEKTAFFVYT	CVVDGCSVIV	RRDAT-FATH	VCFKDCYSIW	EQFCIDNCGE	PWFLTDYNAI
229E	KITEFQLDYS	IDVIDNEIIV	KPNIS-LCVP	LYVRDYVDKW	DDFCRQYSNE	SWFEDDYRAF
PEDV	NYNTPYKTYT	CVVRGDKCCI	TCTLQ-FKAP	SYVEDAVN-F	VDLCTKNIGT	AGFHEFYITA
TGEV	EFRRQSLCFR	AFKDDKSIFF	EAYFKYKMP	ACLAKHIG-L	WNIKKDSCK	RGFLNLFNHL
OC43	DSLGAIIHYL	NSKIVDLAQH	FSDFG-----	TSFVSKIVHF	FRTFTTSTAL	AFAWVLHFVL
BoCoV	DSLGAIIHYL	NSKIVDLAQH	FSDFG-----	TSFVSKIVHF	FRTFTTSTAL	AFAWVLHFVL
MHV	HDVKVATKYV	KKVTGKLAVR	FKALG-----	VAVVRKITET	FDLAVDTAAS	AAGWLCYQLV
AIPV	DGDEIWFDAI	DSVDVEDLGV	VQEKSD-ID	FEVCDVTLF	ENQPGHMQVI	EDDGKNYMEF
SARS CoV	EKLRFIFEWI	EAKLSAGVEF	LKDAW-----	EILKFLITGV	FDIVKGQIQV	ASDNIKDCVK
	725	735	745	755	765	775
EMCR	LQSNPQCAI	VQASESK--V	LLERFLPKCP	EILLSIDGHI	LWNLFVEKFN	FVTDWLKTLK
229E	ISVLDITDAA	VKAAESK--A	FVDTIVPPCP	SILKVIDGGK	IWNGVIKNVN	SVRDWLKSLK
PEDV	HEQQDLQGLF	TTCCMSGFE	CFMPTIPQCP	AVLEEIDGGS	IWRSFITGLN	TMWDFCKRLK
TGEV	NELEDIKETN	IQAIKN----	-----ILCP	DPLLDLDYGA	IWYNCMPGCS	DP-SVLGSVQ
OC43	HGAYIVVESD	IYFVKN----	-IPRYASAVA	QAFQSVAKVV	LDSLRTVTFID	GLSCFPIGRR
BoCoV	HGAYIVVESD	IYFVKN----	-IPRYASAVA	QAFQSVAKVV	LDSLRTVTFID	GLSCFPIGRR
MHV	NGLFAVANGG	ITFLSD----	-VPELVKNFV	DKFKVFFKVL	IDSMSVSVLS	GLTVVKTASN
AIPV	RFKDENIYY	TPMSQLG----	---AINVCK	AGGKTVTFG-	---ETTQEI	PPDVVPIKVS
SARS CoV	CFIDVVNKAL	EMCIDQ----	-----VTIAG	AKLRLNLGE	VETQSKGLY	RQIRGKEQL
	785	795	805	815	825	835
EMCR	LTLSNGLLG	NCAKFRFRLV	VKLLDVYNGF	LETVCSSVHT	AGVCIKYAV	NVP-YVVISG
229E	LNLTQQLLG	TCAKRFKRWL	GILLEAYNAP	LDTVVSTVKI	GGLTFKTYAF	DKP-YIVIRD
PEDV	VSGLDGIUV	TVARKFKRLG	ALLAEMYNTY	LSTVVENLVL	AGVSFKYYAT	SVP-KIVLGG
TGEV	LLIGNG--VK	VVCDGCKGFA	NOLSKGYNKL	CNAARNDIEI	GGIPFSTFTK	PTNTFIEMTD
OC43	RICLSGRKIY	EVERGLLHSS	QLPLDVIYDLT	MPSQVQKAKQ	KPIYLKSGSG	DFSLADSVVE
BoCoV	RICLSGSKIY	EVERGLLHSS	QLPLDVIYDLT	MPSQVQKAKQ	KPIYLKSGSG	DFSLADSVVE
MHV	RVCLAGCKVY	EVVQKRLSAY	VMPVGCNEAT	C-----	---LVGEIE	PAVVEDDVVD
AIPV	IECCGEPWNT	IFKKAYKEPI	EVDTDLTVEQ	LLSVIYKMC	DDLKLFPAP	EPFPPFENVAL
SARS CoV	QLMLPKAPK	EVTFLGDSH	DTVLTSEEVV	LKNGELEALE	TPVDSFTNGA	IVGTPVCVNG
	845	855	865	875	885	895
EMCR	FVSRVIRRR	CD--VTFPCV	SCVTFEYFEL	DTCFGVSK--	---PNAIDVEH	LELKETVFEVE
229E	IVCKVENKTE	AEWIELFPHN	ORIKSFSTFE	SAYMPIAD--	---PTHFDIEE	VELLDAEFVE
PEDV	CFHSVKSVEA	SV--FQIPVQ	AGIEKFVKVL	NCVHPV--	---PRVIETSF	VELEETTFKP
TGEV	AIYSVIEQKG	AL-----	S-----FR	DADVPVVDNG	TISTADWSEP	ILLEPAEYVK
OC43	VVTTSLTPCG	YS-----EPP	KVADKICIVD	NVYMAKAGDK	YYPVVVD-DH	VGLLDQAWRV
BoCoV	VVTTSLTPCG	YS-----EPP	KVADKICIVD	NVYMAKAGDK	YYPVVVD-GH	VGLLDQAWRV
MHV	VVKAPLTYQG	CC-----KPP	TSFEKICVVD	KLYMAKCGDQ	FYPVVVDNDT	IGVLDQCWRF
AIPV	VDRNGDLDC	IKS-----	-----CHLI	YRDYESD--	-----DD	TEEDAEEDD
SARS CoV	LMLLEIKDKE	QY-----	-----CAL	PGLLATN--	-----NV	FRLKGGAPIK
	905	915	925	935	945	955
EMCR	PKDGGQFEVS	DDYLWYVV-D	D-----IY	YPASCVGLP	VAFTKLAGGK	---ISFSDDV
229E	PGCGGILAVI	DEHVYFKK-D	G-----VY	YPSNGTNILP	VAFTKAAGGK	---VSFSDDV
PEDV	PALNGGIAIV	DGFAFYD-G	T-----LY	YPTDGNVVP	ICFKKGGGD	---VKFSDEV
TGEV	PKNNGNVIIV	AGYTFYKDED	E-----HF	YPYGFQKIVQ	RMYNKMGGD	KT-VSFSEEV
OC43	PCAGRRVTFK	EQPTVKEIIS	MPKIKVFYE	LDNDFNTILN	TACGVFEVDD	TVDMEEFYAV
BoCoV	PCAGRCVTFK	EQPTVNEIAS	TPKTIKVFYE	LDKDFNTILN	TACGEFEVDD	TVDMEEFYAV
MHV	PCAGKKEVFN	DKPKVKEIPS	T-RKIKINFA	LDATFDSVLS	KACSEFEVDK	DVTLDELLOV
AIPV	TDSGAEECD	TNSECEEEDE	D-----TK	VLALIQDPAS	IKYPLPLDED	YS-VYNGCIV
SARS CoV	GVTFGEDTVW	EVQGYKNVRI	T-----FE	LDERVDKVLN	EKCSVYTVES	GTEVTEFACV
	965	975	985	995	1005	1015
EMCR	IYHVDPEPTHK	VKLIFEFEED	-VVTSCKKS	FGKSIITG-	DWEGLEHVL	SAMNVIG---
229E	EYKDIPEVYR	VKLCFEFEDE	-KLVDVCEKA	IGKKIKHEG-	DWDSFCKTIQ	SALSUVS---
PEDV	SVKTIIDPVYK	VSLEFEFESE	-TIMAVLNKA	VGNRIKVTG-	GWDDVVEYIN	VAIEVLK---
TGEV	DVQETAPVTR	VKLEFEFDNE	-IVTGVLER	IGTRYKFTGT	TWEEFEESIS	EELDAIFDTL
OC43	VIDAIEEKL	PCKELEGVGA	-KVSALQKL	EDNPLFLFD-	---EAGEEVL	PKLYCAFTAP
BoCoV	VIDAIEEKL	PCKELEGVGA	-KVSALQKL	EDNPLFLFD-	---EAGEEVL	PKLYCAFTAP
MHV	VLDVAVSTLS	PCKEHDVIGT	-KVCALLNRL	AEDYVYLF-	---EGGEEVIA	PKMYCSFSAP
AIPV	HKDALDVVNL	PSGEETFFVN	NCFEGAVKPL	PQKVVDVLG-	---DWGEAVDA	QEQLCQ---
SARS CoV	VAEAVVKTQ	PVSDLLTN--	---MGIDLDEW	SVATFYLF-	---DAGEENFS	SRMYCSFYPP

	1025	1035	1045	1055	1065	1075
EMCR	--QHILRPQF	YIYDEEGGYD	VSKP--VMIS	QWPISDDSDG	CVVEASTDFH	Q--LESVREE
229E	--CYVNLPTY	YIYDEEGGND	LSLP--VMIS	EWPLSVQQAQ	QEATLPDIAE	D--VVDQVEE
PEDV	--DHVEVPKY	YIYDEEGGTD	PNLP--VMIS	QWPLNDDTIS	QDLDLOVEVVT	DAPIDSEGDE
TGEV	ANQGVLEEGY	FIYDTCGGFD	IKNPDGIMIS	QYDINITADE	KSEVSASSEEE	EE-VESVEED
OC43	EDDDFLEESD	VEEDDVEGEE	TDLTVTSAGQ	PCVASEQEEES	SEVLEDTLDD	GPSVETSOSQ
BoCoV	EDDDFLEESG	VEEDDVEGEE	TDLTVTSAGE	PCVASEQEEES	SEILEDTLDD	GPCVETSOSQ
MHV	DDEDCVAADV	VDADENQGGD	ADDSAALVTD	TQEEEDGVAKG	QVGVAESDAR	LQQVEAFDIE
AIPV	--EPLQHTFE	EPVENSTGSS	KTMTEQVVVE	DQELPVVEQD	QDVVVYTPTD	LEVAKETAEE
SARS CoV	DEEEEDDAEC	EEEEIDETCE	HEYGTEDDYQ	GLPLEFGASA	ETVRVEEEEEE	EDWLDDTTEQ

	1085	1095	1105	1115	1125	1135
EMCR	VD-----	-----	-----	-----IIE	QPFGEVEHAL	SIRQ-----
229E	VNS-----	-----	-----	-----IFD	IETVDVKHDV	S-----
PEDV	VDSSAPEKVA	-----D	VANSEPGDDG	LPVAPETNVE	SEVEEVAATL	SFIKDTPTSTV
TGEV	PENIEVEASE	GAGETSSQEE	VETVEVADIT	STEEDVDIVE	VSAKDDPWAA	AVDQVEAEQF
OC43	VEEDVEMS--	-----DFVDL	ESVIQD----	-----	--YENVCFEF	YTT-----
BoCoV	VEEDVQMS--	-----DFGDL	ESVIQD----	-----	--YENVCFEF	YTT-----
MHV	KVEOPILN--	-----ELSAE	LNAPADK----	-TYEDVLAED	AIYSEALSAF	YAVP-----
AIPV	VD-----	-----	-----	-----	-----	-----
SARS CoV	SEIEPEP----	-----	-----	-----E	PTPEEPVNQF	TG-----

	1145	1155	1165	1175	1185	1195
EMCR	---PFSFSFR	DELGVRVLDQ	SDNNCWISTT	LIQLQLTKLL	DDSIEMQLFK	VGKVDISIVQK
229E	---PFEMFFE	ELNGLKILKQ	LDNNCWVNSV	MLQLQLTGIL	DGDYAMOFFK	MGRVAKMIER
PEDV	TKDPFAFDV	SYGGLKVLRL	SHNNCWVTST	LVQLQLLGIV	DDP-AMELFS	AGRVGPMVRK
TGEV	NPSLPPFKTT	NLNGKILKQ	GDNNCWINAC	CYQLQAFDFF	NNE-AWEKFX	KGDVMDVFNL
OC43	-----EPEFV	KVLGLYVPKA	TRNNCWLRSV	LAVMQKLPCQ	FKD--KNLQD	LWVLYKQOYS
BoCoV	-----EPEFV	KVLGLYVPKA	TRNNCWLRSV	LAVMQKLPCQ	FKD--KNLQD	LWVLYKQOYS
MHV	-----GDETHF	KVCGFYSPAI	ERTNCWLRST	LIVMQSLPLE	FKD--LEMQR	LWLSYKSSYN
AIPV	-----EFILIFAVPK	EEVVSQKDKA	QIKQEPQIVV	KPQ--REKKA	KKFKVKPATC	KATNGAMQKE
SARS CoV	-----YKLKTD	NVAIKCVDIV	KEAQSANPMV	IVNAANIHLK	HGGGVAGALN	KATNGAMQKE

	1205	1215	1225	1235	1245	1255
EMCR	CYELSHLISG	SLGDSGKLLS	ELLKDKYTCS	ITFEMSCDCG	KKFDEQVGCL	FWIMPYTKLF
229E	CYTAEQCIRG	AMGDVGLCMY	RLKDLHTGF	MVMDYKCSCT	SGRLEESGAV	LFCTPTKKAF
PEDV	CYESQKAILG	SLGDVSACLE	SLTKDLHTLK	ITCSVVC CGG	TGERIYEGCA	FRMTPTLEPF
TGEV	CYAATTLARG	HSGDAEYLLE	LMLNDYSTAK	IVLAACKCGG	EKEIVLERAV	FKLTPLKESF
OC43	QLFVDTLVNK	IPANIVLPQG	GYVADFAYWF	LTLCDDWQCA	YWKCIKCDLA	LKLKGLDAMF
BoCoV	QLFVDTLVNK	IPANIVLPQG	GYVADFAYWF	LTLCDDWQCA	YWKCIKCDLA	LKLKGLDAMF
MHV	KEFVDKLVKS	VPKSIIILPQ	GYVADFAYFF	LSQCSFKAYA	NWRCLKCDMD	LKLKGLDAMF
AIPV	EKPKFLEYKT	CVGDLTVVIA	KALDEFKEFC	IVNAANEHMT	HGSGVAKAIA	DFCGLDVEY
SARS CoV	SDDYIKLNGP	LTVGGSCLLS	GHNLAKKCLH	VVGPNLNAGE	DIQLLKAAYE	NFNSQDILLA

	1265	1275	1285	1295	1305	1315
EMCR	KQGECCICHK	MQTYKLVSMD	GTGVFVQD--	PAPIDIDAF	VRPICSSVYL	GVKGSQGHYQT
229E	PYGTCLNCNA	PRMCTIRQLQ	GTIIFFVQK-	PEPVNPFVSV	VKPVCSISFR	GAVSCGHYQT
PEDV	PYGACAQCAQ	VLMTHTFKSIV	GTGIFCRD--	TTALSLSLV	VKPLCAAFAI	GK-DSGHYVT
TGEV	NYGVCDCMQ	VNTRCFLSVE	GSGVFVHDIL	SKQTPFAMFV	VKPVMHAVYT	GTTQNGHYMV
OC43	FYGDVVSCHC	KCGESMVLID	VDVPFTAHA	LKDKLFCAFI	TKRIVYKAAC	VVDVNDSSHSM
BoCoV	FYGDVVSCHC	KCGESMVLID	VDVPFTAHA	LKDKLFCAFI	TKRIVYKAAC	VVDVNDSSHSM
MHV	FYGDVVSCHC	KCGTGMTLLS	ADIPYTLHFG	LRDDKFCAFY	TPRKVFRAAC	VVDVNDCHSM
AIPV	CEDYVKKHGP	QORLVTPSFV	KGIQCVNNVV	GPRHGDNHL	EKLVAAYKNV	LVDGVNVYV
SARS CoV	PLLSAGIFGA	KPLQSLQVCV	QTVRTQVYIA	VNDKALYEQV	VMDYLDNLKP	RVEAPKQEEP

	1325	1335	1345	1355	1365	1375
EMCR	NLYSFDKAID	GFGVFDIK--	-----	-----NSSF	NTVCFVDVDF	HS-VEIEAGE
229E	NIYSQNLCDV	GFGVNIQIP-	-----	-----WTNDAL	NTICIKDADY	NAKVEISVTP
PEDV	NFYDAAMAID	GYGRHQIK--	-----	-----YDTL	NTICVKDVNW	TAPLPVAVDS
TGEV	DDIEHGYCVD	GMGIKPLKKR	CYTSTLFINA	NVMTRAEPK	QEFKVEKVEQ	QPIVEENKSS
OC43	AVVDG-KQID	DHRITSIT--	-----	-----SDK	FDPIIGHGMS	FSMTTFEIAQ
BoCoV	AVVDG-KQID	DHRITSIT--	-----	-----SDK	FDPIIGHGMS	FSMTTFEIAQ
MHV	AVVDG-KQID	GKVVTKFN--	-----	-----GDK	YDFMVGHGMA	FSMSAFEIAQ
AIPV	PVLSLGIFGV	DFKMSIDAMR	-----	-----EA	FEGCTIRVLL	FSLSQEHIDY
SARS CoV	PNTEDSKTEE	KSVVQKPVDF	KP-----	-----KIKACIDE	VTTLTEETKF	LTNKLKLLFAD

	1385	1395	1405	1415	1425	1435
EMCR	VK-----	-----	PFAVYKNVKF	YLGDISHLVN	CVSFDVFVNA	ANENLMHGGG
229E	IKNTVDTTPK	EEFVVKERLN	AFLVHDNVAF	YQGDVDTVVN	GVDFDFIVNA	ANENLAHGGG
PEDV	VVEP-----	-----VVK	PFYSYKNVDF	YQGDVDTVVN	-LPCDFVNA	ANEKLSHGGG
TGEV	IEKEEIQSPK	ND---DLIL	PFFYKAGKLSF	YQGALDVLIN	FLEPDVIVNA	ANGDLKHMGG
OC43	LYG-----	-----	-SCITPNVCF	VKGDIKVS	LVKAEVVVNP	ANGHMAHGGG
BoCoV	LYG-----	-----	-SCITPNVCF	VKGDIKVS	RVKAEVVVNP	ANGHMAHGGG
MHV	LYG-----	-----	-SCITPNVCF	VKGDIKVS	RVKAEVVVNP	ANGHMAHGGG
AIPV	FD-----	-----	-----VTC	KOKTIYLTED	GVKYRSIVLK	PGDSLQFGQ
SARS CoV	INGKLYHD--	-----SQ	NMLRGEDMSF	LEKDAPYHVG	DVITSGDITC	VVIPSKKAGG

	1445	1455	1465	1475	1485	1495
EMCR	VARAIDILTE	GQLQSLSKDY	ISSNGPLKVG	AGVMLE--CE	KFNVENNVGP	RTG---KHEH
229E	LAKALDVYTK	GKLQRLSKEH	IGLAGKVKVG	TGVMVE--CD	SLRIFNVVGP	RKG---KHER
PEDV	IAKAIDVYTK	GMLQKCSNDY	IRAHGPIKVG	RGVMLE--AL	GLKVENNVGP	RKG---KHAP
TGEV	VARAIDVFTG	GKLTERRSKDY	LKKNKSIAPG	NAVFENVIE	HLSVLNAVGP	RNGD--SRVE
OC43	VAKAIAVAAG	QQFVKETTDM	VKSKGVCATG	DCYVSTGGKL	CKTVLNVVGP	DARTQCKQSY
BoCoV	VAKAIAVAAG	QQFVKETTDM	VKSKGVCATG	DCYVSTGGKL	CKTVLNVVGP	DARTQCKQSY
MHV	VAGAIKAAAG	KSFIKETADM	VRNQGVCQVG	ECYESTGGNL	CKTVLNVVGP	DARGHGKQCY
AIPV	VYAKNKIVFT	ADDVEDKEIL	YVPTTDKSIL	EYGLD---A	QKYVIYLOTL	AQKWNVQYRD
SARS CoV	TTEMLSRALK	KVPVDEYITT	YPGQCAGYT	LEEAKTALKR	CKSAFYVLPS	EAPNAKEEIL
	1505	1515	1525	1535	1545	1555
EMCR	SLLVEAYNSI	LF---ENGIP	LMPLLSCGIF	GVRIENSLKA	LFSCDINKPL	QVFVYSSNEE
229E	DLLIKAYNTI	NN---EQGTP	LTPILSCGIF	GIKLETSLEV	LLDVCNTKEV	KVFVYTDTEV
PEDV	ELLVKAYKSV	FA---NSGVA	LTPLISVGIF	SVPLEESLSA	FLACVGDHRH	KCFYCGDKER
TGEV	AKLCNVYKAI	AK---CEGKI	LTPLISVGIF	NVRLETSLOC	LLKTVNDRGL	NVFFVYTDQER
OC43	VLLERVYKHL	N---NYDCV	VTTLISAGIF	SVPSDVSLTY	LLGTAKKQVV	LVSNNQEDFD
BoCoV	ALLERVYKHL	N---KYDCV	VTTLISAGIF	SVPSDVSLTY	LLGTAKKQVV	LVSNNQEDFD
MHV	SFLERAYQHI	N---KCDDV	VTTLISAGIF	SVPTDVSLTY	LIGVVTKNVI	LVSNNKDDFD
AIPV	NFLILEWRDG	N---CWISS	AIVLLQAAKI	RFKGFLTEAW	AKLLGGDPTD	FVAWCYASCT
SARS CoV	GTVSWNLREM	LAHAETRKRL	MPICMDVRAI	MATIQKRYKG	IKIQEGIVDY	GVRFFFTYSK
	1565	1575	1585	1595	1605	1615
EMCR	QAVLKFLDGL	DLTPVID---	-----DQDVV	-----	-KPFVRVEGNF	SFFDCG---V
229E	CRVKDFVSGI	VNVQKVE---	-----QPKIE	PKPVSIVKVA	PKPYRVDGKF	SYFTED---L
PEDV	EATIKYMDGL	VDAIFKEALV	DTTPVQEDVQ	QVSQKPVLPN	FEPFRIEGAH	AFYECPNPEGL
TGEV	QTIENFFS---	-----	-----	-----	-----	-----
OC43	LISKQCITAV	EG-----	-----	-----	-----	-----T
BoCoV	LISKQCITAV	EG-----	-----	-----	-----	-----T
MHV	VIEKQVTSI	AG-----	-----	-----	-----	-----T
AIPV	AKVGDFSDAN	-----	-----	-----	-----	-----
SARS CoV	EPVASIITKL	N-----	-----	-----	-----	-----S
	1625	1635	1645	1655	1665	1675
EMCR	NALDGD-IYL	LFTNSILMLD	KQGQLDTRL	NGILOQAVLD	YLATVKTVPA	GNLVLKLVVE-
229E	LCVADDKPIV	LFTDSMLTLD	DRGLALDNL	SGVLSAAIKD	CVDINKAIPS	GNLIKFDIG-
PEDV	MSLGAD-KLV	LFTNSNLDFC	SVGKCLNDVT	SGALLEAINV	FKSNKTVPA	GNCVTLDCAN
TGEV	-----	-----	-----	-----	-----	-----
OC43	KKLAERLSFN	VGRSIVYETD	ANKLILIN--	-DVAFVSTFN	VLQDVLSLRH	DIALDDDDART
BoCoV	KKLAERLSFN	VGRSIVYETD	ANKLILIN--	-DVAFVSTFN	VLQDVLSLRH	DIALDDDDART
MHV	KALSLQLAKN	LCRDVKFETN	ACDSLFS---	-DSCFVSSYD	VLQVEVLLRH	DIQLDDDDARV
AIPV	-----	-----	-----	-----	-----WLLA	NLAEHFDADY
SARS CoV	LNEPLVTMPI	GVYTHGFNLE	EAARCMR---	-SLKAPAVVS	VSSPDAVTTY	NGYLTSSSKT
	1685	1695	1705	1715	1725	1735
EMCR	SCTIYMCVVP	SI-NDLSFDK	NLGRCVRKLN	RLKTCVIANV	PAIDVLKLL	SSLTLTVKFV
229E	SVVVMCVVP	SE-KDKHLDN	NVQRCTRKLN	RLMCDIVCTI	PADYILPLVL	SSLTCNVSVF
PEDV	MISITMVVLP	FD-GDANYDK	NYARAVVKVS	KLKGLVLAV	DDATLYSKLS	--HLSVLGFV
TGEV	-----CSIP	-----	-----	-----	-----	-----
OC43	FVQSNVDVVP	EG-WRVVNKF	YQINGVRTVK	YFECTGGIDI	CSQDKVFGYV	QOGIFNKATV
BoCoV	FVQSNVDVVP	EG-WRVVNKF	YQINGVRTVK	YFECTGGIDI	CSQDKVFGYV	QOGIFNKATV
MHV	FVQAHMDNLP	AD-WRLVNKF	DSVDGVRTVK	YFECPPGEIFV	SSQKKRFGYV	QNGSFKVASV
AIPV	TNAFLKKRVS	CN-----	-----	-----CG--	-----	-----
SARS CoV	SEEHFVETVS	LAGSYRWSY	SGQRTLGVE	FLKRGDKIVY	HTLESPVEFH	LDG--EVLSL
	1745	1755	1765	1775	1785	1795
EMCR	VESNVMDVND	CFKNDNVVLK	ITEDGINVKD	VVVESSKSLG	KQLG-VVSDG	VDSFEGVLP-
229E	GELKAAEA--	-----KVITIK	VTEDGVNVHD	VTVTDDKSFE	QQVG-VIAOK	DKDLSGAVPS
PEDV	STPDQVER--	FYANKSVVVK	VTEDTRSVKA	VKVESTATYG	QQIG-PCLVN	DTVVTDNKP-
TGEV	-----	-----VN	VTEDNVNHER	VSVSFDKTYG	EQLKGTVVVK	DKDVTNQLPS
OC43	AQIKALFLD-	-----KVDIL	LTVDGVNFTN	RFVPVGESFG	KSLG-NVFC	GVNVTKHKCD
BoCoV	AQIKALFLD-	-----KVDIL	LTVDGVNFTN	RFVPVGESFG	KSLG-NVFC	GVNVTKHKCD
MHV	SQIRALLAN-	-----KVDVL	CTVDGVNFTN	CCVAEGEVFG	KTIG-SVFC	GINVTKVRCS
AIPV	-----	-----IKSYE	LRGLEACIQP	VRATNLLHFK	TQYSNCPCTG	ANNTDEVIEA
SARS CoV	DKLSKLLSLR	--EVKTIKVF	TTVDNTNLHT	QLVDMSTYTG	QQFG-PTYLD	GADVTKIKPH
	1805	1815	1825	1835	1845	1855
EMCR	-INTDTVLSV	APEVDWVAFY	GFKAALFAS	LDVKPYG---	-----YPNDF	VGGFRVLGTT
229E	DLNTESELLTK	AIDVDWVEFY	GFKAADVTEAT	VDHSAFA---	-----YESAV	VNGIRVLKTS
PEDV	-VVADVVAKV	VPANWOSHY	GFDAKAGEFH	LDHTGFT---	-----FPSEV	VNGRRVIKTT
TGEV	AFDVGGQVIK	AIDIDWQAHY	GFRDAAAFSA	SSHDAK---	-----FEVVT	HSNFIVHKQT
OC43	INYKGVVFFQ	FDNLSSDDLK	AVRSSFNFDQ	KELLAYNNML	VNCFKQWQVV	NGKYFTFKQA
BoCoV	INYKGVVFFQ	FDNLSSDDLK	AVRSSFNFDQ	KELLAYNNML	VNCFKQWQVV	NGKYFTFKQA
MHV	AIHKGKVVFFQ	YSGLSAADLV	AVTDAFGFDE	PQLLKYNNML	G-MCKWPVVV	CGNYFAFKQS
AIPV	SLPYLLLFAT	DGPATVDCDE	DAVGTVVFG	STNSGHCY--	-----TQA	AGQAFDNLAK
SARS CoV	VNHEGKTFEV	LPSDDTLRSE	AFEYHTLDE	SFLGRYMSAL	NHTKKWFFQ	VGGLTSIKWA

	1865	1875	1885	1895	1905	1915
EMCR	DNNCWVNATC	IILQYLKPTF	RSKGLNVLWN	KFVTGDVGPF	VSFIYFITMS	SKGQKGAEE
229E	DNNCWVNATC	IILQYLKPTF	RSKGLNVLWN	KFVTGDVGPF	VSFIYFITMS	SKGQKGAEE
PEDV	DNNCWVNATC	IILQYLKPTF	RSKGLNVLWN	KFVTGDVGPF	VSFIYFITMS	SKGQKGAEE
TGEV	DNNCWVNATC	IILQYLKPTF	RSKGLNVLWN	KFVTGDVGPF	VSFIYFITMS	SKGQKGAEE
OC43	DNNCWVNATC	IILQYLKPTF	RSKGLNVLWN	KFVTGDVGPF	VSFIYFITMS	SKGQKGAEE
BoCoV	DNNCWVNATC	IILQYLKPTF	RSKGLNVLWN	KFVTGDVGPF	VSFIYFITMS	SKGQKGAEE
MHV	DNNCWVNATC	IILQYLKPTF	RSKGLNVLWN	KFVTGDVGPF	VSFIYFITMS	SKGQKGAEE
AIPV	DNNCWVNATC	IILQYLKPTF	RSKGLNVLWN	KFVTGDVGPF	VSFIYFITMS	SKGQKGAEE
SARS CoV	DNNCWVNATC	IILQYLKPTF	RSKGLNVLWN	KFVTGDVGPF	VSFIYFITMS	SKGQKGAEE

	1925	1935	1945	1955	1965	1975
EMCR	ALSKLSEYLI	S-----	DSIVTLE	QYSTCDIC--	-----	-----
229E	ALSKLSEYLI	S-----	DSIVTLE	QYSTCDIC--	-----	-----
PEDV	ALSKLSEYLI	S-----	DSIVTLE	QYSTCDIC--	-----	-----
TGEV	ALSKLSEYLI	S-----	DSIVTLE	QYSTCDIC--	-----	-----
OC43	ALSKLSEYLI	S-----	DSIVTLE	QYSTCDIC--	-----	-----
BoCoV	ALSKLSEYLI	S-----	DSIVTLE	QYSTCDIC--	-----	-----
MHV	ALSKLSEYLI	S-----	DSIVTLE	QYSTCDIC--	-----	-----
AIPV	ALSKLSEYLI	S-----	DSIVTLE	QYSTCDIC--	-----	-----
SARS CoV	ALSKLSEYLI	S-----	DSIVTLE	QYSTCDIC--	-----	-----

	1985	1995	2005	2015	2025	2035
EMCR	-----	-----	KSTVVEVKA	VVCASVLKDG	-----	CDVGFCPHRH
229E	-----	-----	KSTVVEVKA	VVCASVLKDG	-----	CDVGFCPHRH
PEDV	-----	-----	KSTVVEVKA	VVCASVLKDG	-----	CDVGFCPHRH
TGEV	-----	-----	KSTVVEVKA	VVCASVLKDG	-----	CDVGFCPHRH
OC43	-----	-----	KSTVVEVKA	VVCASVLKDG	-----	CDVGFCPHRH
BoCoV	-----	-----	KSTVVEVKA	VVCASVLKDG	-----	CDVGFCPHRH
MHV	-----	-----	KSTVVEVKA	VVCASVLKDG	-----	CDVGFCPHRH
AIPV	-----	-----	KSTVVEVKA	VVCASVLKDG	-----	CDVGFCPHRH
SARS CoV	-----	-----	KSTVVEVKA	VVCASVLKDG	-----	CDVGFCPHRH

	2045	2055	2065	2075	2085	2095
EMCR	KLSRVKFN	G-----	-----	-----	-----	-RVVITNVGE
229E	KLSRVKFN	G-----	-----	-----	-----	-RVVITNVGE
PEDV	KLSRVKFN	G-----	-----	-----	-----	-RVVITNVGE
TGEV	KLSRVKFN	G-----	-----	-----	-----	-RVVITNVGE
OC43	KLSRVKFN	G-----	-----	-----	-----	-RVVITNVGE
BoCoV	KLSRVKFN	G-----	-----	-----	-----	-RVVITNVGE
MHV	KLSRVKFN	G-----	-----	-----	-----	-RVVITNVGE
AIPV	KLSRVKFN	G-----	-----	-----	-----	-RVVITNVGE
SARS CoV	KLSRVKFN	G-----	-----	-----	-----	-RVVITNVGE

	2105	2115	2125	2135	2145	2155
EMCR	PIISQPSKLL	NGIA--YTTF	S-----	-----	NGHYVVDAA	NNAVYDGAEL
229E	PIISQPSKLL	NGIA--YTTF	S-----	-----	NGHYVVDAA	NNAVYDGAEL
PEDV	PIISQPSKLL	NGIA--YTTF	S-----	-----	NGHYVVDAA	NNAVYDGAEL
TGEV	PIISQPSKLL	NGIA--YTTF	S-----	-----	NGHYVVDAA	NNAVYDGAEL
OC43	PIISQPSKLL	NGIA--YTTF	S-----	-----	NGHYVVDAA	NNAVYDGAEL
BoCoV	PIISQPSKLL	NGIA--YTTF	S-----	-----	NGHYVVDAA	NNAVYDGAEL
MHV	PIISQPSKLL	NGIA--YTTF	S-----	-----	NGHYVVDAA	NNAVYDGAEL
AIPV	PIISQPSKLL	NGIA--YTTF	S-----	-----	NGHYVVDAA	NNAVYDGAEL
SARS CoV	PIISQPSKLL	NGIA--YTTF	S-----	-----	NGHYVVDAA	NNAVYDGAEL

	2165	2175	2185	2195	2205	2215
EMCR	FASD-----	-----	-----	-----	--LSTLAVTA	IVVVGCVTS
229E	FASD-----	-----	-----	-----	--LSTLAVTA	IVVVGCVTS
PEDV	FASD-----	-----	-----	-----	--LSTLAVTA	IVVVGCVTS
TGEV	FASD-----	-----	-----	-----	--LSTLAVTA	IVVVGCVTS
OC43	FASD-----	-----	-----	-----	--LSTLAVTA	IVVVGCVTS
BoCoV	FASD-----	-----	-----	-----	--LSTLAVTA	IVVVGCVTS
MHV	FASD-----	-----	-----	-----	--LSTLAVTA	IVVVGCVTS
AIPV	FASD-----	-----	-----	-----	--LSTLAVTA	IVVVGCVTS
SARS CoV	FASD-----	-----	-----	-----	--LSTLAVTA	IVVVGCVTS

	2225	2235	2245	2255	2265	2275
EMCR	-----	-----	-----	-----	-----	-----
229E	-----	-----	-----	-----	-----	-----
PEDV	-----	-----	-----	-----	-----	-----
TGEV	-----	-----	-----	-----	-----	-----
OC43	-----	-----	-----	-----	-----	-----
BoCoV	-----	-----	-----	-----	-----	-----
MHV	-----	-----	-----	-----	-----	-----
AIPV	-----	-----	-----	-----	-----	-----
SARS CoV	-----	-----	-----	-----	-----	-----

	2285	2295	2305	2315	2325	2335
EMCR	-----NVPP	IVSEKISVMD	KLDTG-----	-----	-----	-----
229E	-----PV	NTVKPKPVIN	QLDEK-----	-----	-----	-----
PEDV	-----IKDP	VKKAELDATK	LLODMNY-----	-----	-----	-----
TGEV	-----KN	CAFNKVAASP	KIVQEQKLLA	IESGANY-----	-----	-----
OC43	KEINIILSG	VKKPFKVEDS	VIVNDDTSET	KYVKSLSIVD	VYDMWLTGCK	YVVRTANALS
BoCoV	REINIILSG	VKKPFKVEDS	VIVNDDTSEI	KYVKSLSIVD	VYDMWLTGCR	CVVRTANALS
MHV	VDVKEVKLNG	VKKPIKVEDS	VVVNDPTSET	KVVKLSLSIVD	VYDMFLTGCR	YVVWMANALS
AIPV	-----IAKK	AIVGSSVVTT	QCCKLIG-----	-----	-----	-----
SARS CoV	PTIQKEVIEC	DVKTTEVVG	VILKPSDEGV	KVTQELGHED	LMAAYVENTS	ITIKKPNELS
	2345	2355	2365	2375	2385	2395
EMCR	-----AQK	FFQPGDFVMN	N-----	-----IV	LFLTWLLSMF	-----
229E	-----AQK	FFDFGDFLIH	N-----	-----FV	IFFTWLLSMF	-----
PEDV	-----ASER	FFSFGDFMSR	N-----	-----LI	TVFLYILSIL	-----
TGEV	-----ALTE	FGRYADMFFM	A-----	-----GD	KILRLLELVF	-----
OC43	RAVNVPTIRK	FIKFGMTLVS	IPIDLLNLRE	IKPAVNVVKA	VRNKISVCFN	FIKWLFLVLLF
BoCoV	RAVNVPTIRK	FIKFGMTLVS	IPIDLLNLRE	IKPVENNVKA	VRNKISACFN	FIKWLFLVLLF
MHV	RLVNSPTVRE	VYKNGMTKIV	IPAKLVLLRD	EKQEPVAPKV	VKAKVIACYS	AVKWWFFLYCF
AIPV	-----K	AATFIADKVG	G-----	-----G	VVRNITDSIK	-----
SARS CoV	LALG---LKT	IATHGIAAIN	SVPWSKILAY	VKPFILG--QA	AITTSNCAKR	LAQRVENNYM
	2405	2415	2425	2435	2445	2455
EMCR	SLLRTSIMKH	DIKVIKAPK	RTGVILTRSF	KYNIRSAFV	VRQKWC-VIV	TLFKFLLLLY
229E	TLCKTAVTTG	DVKIMAKAPQ	RTGVVLKRS	KYNLKASAAV	LKSKMW-LLA	KFTKLLLLY
PEDV	GLCFRAFRKR	DVKVLAVGPQ	RTGIILRKSM	RYNAKALGVF	FKLKY-WFK	VLGKFSLSGIY
TGEV	KYLLVLFMCL	RSTKMPKVKV	KP-PLAFKDF	GAKVRTLNVM	RQLNKP-SWV	RYAKLVLLLI
OC43	GWIKISADNK	VIYTTETASK	LTCKLVALAF	KNAFLTFFKS	MVARGA-CII	ATIFLLWFNF
BoCoV	GWIKISADNK	VIYTTETASK	LTCKLVALAF	KNAFLTFFKS	VVARGA-CII	ATIFLLWFNF
MHV	SWIRFNTDNK	VIYTTETASK	LTFLNLCLAF	KNALQTFNWN	VVSRGF-FLV	ATVFLWFNF
AIPV	GLCGITRGHF	ERKMSPQFLK	TLMFLLFYFL	KASVKSVAAS	YKTVLCKVVL	ATLLIVWFVY
SARS CoV	PYVFTLLFQL	CTFTKSTNSR	IRASLPTTIA	KNSVKSVAKL	CLODAGI-NYV	KSPKFSKLFT
	2465	2475	2485	2495	2505	2515
EMCR	AIYALVFMI	QFSPFNSL-L	CGDIVSGYEK	STF-----	-----NK	DIYCGNSMVC
229E	TLYSVLLCV	RFGPFN---F	CSETVNGYAK	SNF-----	-----VK	DDYCDGSLGC
PEDV	ALYALFMTI	RFTPIGSP-V	CDDVVAGYAN	SSF-----	-----DK	NEYCN-SVIC
TGEV	AIYNFFYLFV	SIPVVHKL-T	CNGAVQAYKN	SSF-----	-----IK	SAVCGNSILC
OC43	IYANVIFSDF	YLPKIGFLPT	FVGKIAQWIK	NTFSLVTICD	LYSMQDVGFK	NOYCNGSIAC
BoCoV	IYANVIFSDF	YLPKIGFLPT	FVGKIAQWIK	NTFSLVTICD	LYSIQDVGFK	NOYCNGSIAC
MHV	LYANVILSDF	YLPNIGFFPT	FVGQIVAWVK	TTFGIFTLCD	LYQVSDVGYR	SSFCNGSMVC
AIPV	TSNPVMTGI	RVLDLFEFS	LCGPYKDYGK	DSFD-----	-----VL	R-YCADDIFIC
SARS CoV	IAMWLLLSI	CLGSLICVTA	AFGVLLSNFG	APSYCNGVRE	LYLNSSNVTT	MDFCEGSFPC
	2525	2535	2545	2555	2565	2575
EMCR	KMCLFSYQEF	NLDLHTSLVW	KHIR-----DP	ILISLQPFVI	LVILLIFG--	-----
229E	KMCLFGYQEL	SQFSLHDVVM	KHIT-----DP	LFSNMQPFIV	MVLLIFG--	-----
PEDV	KVCLYGYQEL	SDFSHTQVVM	QHLR-----DP	LIGNVMPFFY	LAFLAIFG--	-----
TGEV	KACLASYDEL	ADFQHLQVTV	DFKS-----DP	LWNLRLVQLSY	FAFLAVFG--	-----
OC43	QFCLAGFDML	DNYKAIDVVQ	YEAD-----RR	AFVDYTGVLK	IVIELIVSYA	LYTAWFYPLF
BoCoV	QFCLAGFDML	DNYKAIDVVQ	YEAD-----RR	AFVDYTGVLK	IVIELIVSYA	LYTAWFYPLF
MHV	ELCFSGFDML	DNYDAINVQ	HVVD-----RR	VSFYDYSLEK	LVVELVIGYS	LYTVCFYPLF
AIPV	RVCLHDKDSL	HLVKHAYSVE	QVYKDAASGF	IFNWNWLYLV	FLILFVKP--	-----
SARS CoV	SICLSGLDSL	DSYPALETIQ	VTISSYKLDL	TILGLAAEWV	LAYMLFTKFF	YLLG-----L
	2585	2595	2605	2615	2625	2635
EMCR	NMYLRFGLLY	FVAQFISTFG	SFLGFHQKQW	FLHFVPFDVL	CNEFLATFIV	CKIVLFVRHI
229E	DNYLRCFLLY	FVAQMISTVG	VFLGYKETNW	FLHFIPFDVI	CDELLVTIV	IKVISFVRHV
PEDV	GVYVKAITLY	FIFQYLSNLG	VFLGLQSQIW	FLQLVPFDVF	GDEIVVFFIV	TRVLMFIKHV
TGEV	NNYVRCFLMY	FVSQYLNLNL	SYFGYVEYSW	FLKVVNFESI	SAEFVIVVIV	VKAVLALKHI
OC43	ALISIQILTT	WLPELFMLST	LHWSFRLLVA	LANMLPAHVF	MRFYIIIASF	IKLFSLFVRHV
BoCoV	ALISIQILTT	WLPELFMLST	LHWSFRLLVS	LANMLPAHVF	MRFYIIIASF	IKLFSLFVRHV
MHV	GLIGMQLLTT	WLPEFFMLET	MHWSARFFVF	VANMLPAFTL	LRFYIVVTAM	YKIFCLCRHV
AIPV	VAGEVVICYC	VKYLVLNSTV	LQTGVCFLDW	FVQTVFSHFN	FMGAGFYFWL	FYKIYIQVHH
SARS CoV	SATMQVFFGY	FASHFISNS-	--WLMWFIIS	IVQMAPVSAM	VRMYIFFASF	YYIWKSYVHI
	2645	2655	2665	2675	2685	2695
EMCR	IVGCNNADCV	ACSKSARLKR	VPLQTIINGM	HKSFYVNANG	GTCFCNKHNF	FCVNCDSFGP
229E	LFGCENPDCI	ACSKSARLKR	FPVNTIVNGV	QRSFYVNANG	GSKFCKKHNF	FCVDCDSYGY
PEDV	CLGCDKASCV	ACSKSARLKR	VPVQTIQGT	SKSFYVHANG	GSKFCKKHNF	FCLNCDSYGP
TGEV	VFACSNPSCK	TCSRTARQTR	IPIQVVVNGS	MKTVVVHANG	TGKFCCKHNF	YCKNCDSYGF
OC43	AYGCSKSGCL	FCYKRNRSR	VKCSSTIVGGM	IRYVDVMANG	GTGFCCKHNF	NCIDCDSYKP
BoCoV	AYGCSKSGCL	FCYKRNRSR	VKCSSTIVGGM	IRYVDVMANG	GTGFCCKHNF	NCIDCDSYKP
MHV	MYGCSRPCL	FCYKRNRSR	VKCSSTIVGGM	IRYVDVMANG	GTGFCCKHNF	NCLNCDSYGP
AIPV	ILYCKDVTC	VCKRVARSNR	QEVSVVVGGR	KQIVHVVTNS	GYNFCKRHNW	YCRNCDDYGH
SARS CoV	MDGCTSSCTM	MCYKRNRSR	VECTTIVNGM	KRSFYVYANG	GRGFCCKHNF	NCLNCDSYGP

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	2705	2715	2725	2735	2745	2755	
EMCR	GNTFFINDIA	RELGNVVKTA	VQPTAPAYVI	IDKXDFVNGF	YRLYSGDTFW	RYDFDITESK	
229E	GSTFITPEVS	RELGNITKTN	VQPTGPAYVM	IDKVEFENG	YRLYSCETFW	RYNFDITESK	
PEDV	GCTFINDVIA	TEVGNVVKLN	VQPTGPATIL	IDKVEFSNGF	YRLYSGDTFW	KYNFDITDSK	
TGEV	ENTFICDEIV	RDLNSNVKQT	VYATDRSHQE	VTKVECSDFG	YRFYVGDEFT	SYDYDVKHHK	
OC43	GNTFITVEAA	LDLSKELKRP	IQPTDVAYHT	VTDVKQVGC	MRLFYDRDGO	RTYDDVNASL	
BoCoV	GNTFITVEAA	LDLSKELKRP	IQPTDVAYHT	VTDVKQVGCY	MRLFYDRDGO	RTYDDVNASL	
MHV	GNTFITHEAA	ADLSKELKRP	VNPTDSAYYL	VTEVKQVGC	MRLFYERDGO	RVYDDVSASL	
AIPV	QNTFMSPEVA	GELSEKLKRP	VKPTAYAYHV	VDEACLVDDF	VNLKYKAATP	GKDSASSAVK	
SARS CoV	GSTFISDEVA	RDLSLQFKRP	INPTDQSSYI	VDSVAVKNGA	LHLVFDKAGO	KTYERHPLSH	
						
	2765	2775	2785	2795	2805	2815	
EMCR	YSCKEVLKLN	-----	CNVLENFIVY	NNSGS--NIT	QIKNACVYFS	QLLCEPIKLV	
229E	YSCKEVFKN	-----	CNVLDDEFIV	NNNGT--NVT	QVKNASVYFS	QLLCRPIKLV	
PEDV	YTCKEALKN	-----	CSIIITDFIV	NNNGS--NVN	QVKNACVYFS	QMLCKPVKLV	
TGEV	YSSQEVKLS	-----	MLLLDDFIVY	SPSGS--ALA	NVRNACVYFS	QLIGKPIKLV	
OC43	FVDYSNLLHS	-----KV	KSVPMHVVV	VENDA--DKA	NFLNAAVFYA	QSLFRPILMV	
BoCoV	FVDYSNLLHS	-----KV	KSVPMHVVV	VENDA--DKA	NFLNAAVFYA	QSLFRPILMV	
MHV	FVDMNGLLHS	-----KV	KGVPEHVVV	VENEA--DKA	GFLNAAVFYA	QSLYRPMMLV	
AIPV	CFSVTDFLK	AVFLKEALKC	EQISNDGFIV	CNTQSAHALE	EAKNAAIYYA	QYLCKPILIL	
SARS CoV	FVNLONLRAN	-----NT	KGSLPINVIV	FDGKSKCDES	ASKSASVYYS	QLMCQPILL	
						
	2825	2835	2845	2855	2865	2875	
EMCR	NSELLSTLS-	-VDFNGVLHK	AYVDVLCNSF	FKELTANMSM	AECKATLGLT	-----	
229E	DSELLSTLS-	-VDFNGVLHK	AYIDVLRNSF	GKDLNANMSL	AECKRALGLS	-----	
PEDV	DSALLASLS-	-VDFGASLHS	AFVSVLSNSF	GKDLSSCNM	QDCKSTLGLD	D-----	
TGEV	NSDLLEDLS-	-VDFKGALFN	AKKNVKNKSF	NVDVSECKNL	DECYRACNLN	-----	
OC43	DRNLITTANT	GTSVTETMFD	VYVDTFLSMF	DVDKKSLLNAL	IATAHSSIKQ	GTQIYKVLDT	
BoCoV	OKILITTANT	GTSVTETMFD	VYVDTFLSMF	DVDKKSLLNAL	IATAHSSIKQ	GTQICKVLDT	
MHV	EKKLITTANT	GLSVSQTMFD	LYVDSLLGVL	DVDRKSLTSE	VNAAHNSLKE	GVQLEQVMDT	
AIPV	DQALYEQLVV	-EPVSKSVID	KVCSILSSII	SVDTAALNYK	AGTLRDALLS	-----	
SARS CoV	DQVLSVDVGD	STEVSVKMF	AYVDTFSATF	SVPMEKLKAL	VATAHSELAK	GVALDGVLS	
						
	2885	2895	2905	2915	2925	2935	
EMCR	-----	-----VSDDDF	VSAVANAHRY	DVLLSDLSFN	NFFISYAKPE	DK-LSVYDIA	
229E	-----	-----ISDHEF	TSAISNAHRC	DVLLSDLSFN	NFVSSYAKPE	EK-LSAYDLA	
PEDV	-----	-----VPLDTF	NAAVAEAHRY	DVLLTDMSEF	NFTTSYAKPE	EK-FPVHODIA	
TGEV	-----	-----VSFSTF	EMAVNNAHRE	GILITDRSFN	NFWPSKVKPG	SSGSVAMDIG	
OC43	FLSCARKSCS	IDSDDVTKCL	ADSVMSAVSA	GLELTDESCN	NLVPTYLKSD	N--IVAADLG	
BoCoV	FLSCARKSCS	IDSDDVTKCL	ADSVMSAVSA	GLELTDESCN	NLVPTYLKSD	N--IVAADLG	
MHV	FTGCARRKCA	IDSDDVTKSI	TKSIMSAVNA	GVDFTDESCN	NLVPTYVKSD	T--IVAADLG	
AIPV	-----	-----ITKDEEA	VDMAIFCHNH	DVDYTGOGFT	NVIPSYGIDT	G-KLTPRDRG	
SARS CoV	FVSAARQG-V	VDTDVDTKDV	IECLKLSHHS	DLEVTDGSCN	NFMLTYNKVE	N--MTPRDLG	
						
	2945	2955	2965	2975	2985	2995	
EMCR	CCMRAGSKVV	NHNVLKESI	PIVGVKDFN	TLSQEGKKYL	VKTKKAGLT	FLLTFNDNQA	
229E	CCMRAGAKVV	NANVLTKDQT	PIVWHAKDFN	SLSAEGRKYI	VKTSKAGLT	FLLTINENQA	
PEDV	TCMRVGAIV	NHNVLKDSI	PVVWLVRDFI	ALSEETRYKI	IRTTKVKGT	FMLTFNDCRM	
TGEV	KCMTSDAKIV	NAKVLTRQCK	SVVWLSQDFA	ALSSTAQKVL	VKTFVEEGVN	FSLTFNAVGS	
OC43	VLIQNSAKHV	QGNVAKIAGV	SCIWSVDAFN	QFSSDFQHKL	KKACCKTGLK	LKLTYNKQMA	
BoCoV	VLIQNSAKHV	QGNVAKIAGV	SCIWSVDAFN	QLSSDFQHKL	KKACCKTGLK	LELTYNKQMA	
MHV	VLIQNSAKHV	QANVAKAANV	ACIWSVDAFN	QLSADLQHRL	RKACSKTGLK	IKLTYNKQEA	
AIPV	FLINADASIA	NLRVKN--AP	PVVWKFSELI	KLSDSLKLYL	ISATVKSQVR	FFITKSGAKQ	
SARS CoV	ACIDCNARHI	NAQVAKSHNV	SLIWNVVDYM	SLSEQLRKQI	RSAAKKNPIP	FRLTCATTRQ	
						
	3005	3015	3025	3035	3045	3055	
EMCR	ITQVP-----	TSIVAKQGAG	-----	FKRTYNFLWY	VCLFVVALFI	GVSFID----	
229E	VTQIP-----	TSIVAKQGAG	D-----	AGHSLTWLWL	LCGLVCLIQF	YLCFFMPY--	
PEDV	HTTIP-----	VCIANKKGAG	LP-----	SFSKVKFFWF	LCLFIVAAFF	ALSFLD----	
TGEV	DDDLPYERFT	ESVSPKSGSG	-----	FFDVITQLKQ	IVILVVFVIF	ICGLCSVYSV	
OC43	NVSVL-----	TPFSLKGGAV	FS-----	FVYVCFVLSL	VCFIGLWCLM	PTYTVH----	
BoCoV	NVSVL-----	TPFSLKGGAV	FS-----	FVYVCFVLSL	VCFIGLWCLM	PTYTVH----	
MHV	NVPIL-----	TPFSLKGGAV	FS-----	KVLQWLFVNL	ICFIVLWALM	PTYAVH----	
AIPV	VIACHT--QK	LLVEKKAGGI	VSGTFKCFKS	YFKWLLIFYI	LFTACCSGY	YMEVSKSEVH	
SARS CoV	VVNVI-----	TKISLKGKGI	VS-----	CFKMLMLKATL	LCVLAALVCY	IVMPVHTLS-	
						
	3065	3075	3085	3095	3105	3115	
EMCR	-YTTTIVTSFH	GYDFKYIENG	QLKVFAPLH	CVRNVDFDNF	QWHEAKFGVV	TTNSD-KCPI	
229E	FMYDIVSSFE	GYDFKYIENG	QLKNFEAPLK	CVRNVDFENF	DWHYAKFGFT	PLNKQ-SCPI	
PEDV	-FSTQVSSDS	DYDFKYIESG	QLKTFDNPLS	CVHNVFINFD	QWHDAGFGFT	PVNNP-SCPI	
TGEV	ATQSYIESAE	GYDMYIKNG	IVQPFDDTIS	CVHNTYKGGF	DWFKAKYGF	PTFGK-SCPI	
OC43	--KSDFLQPV	YASYKVLONG	VIRDVSVEDV	CFANKFEQFD	QWYESTFGLS	YYSNSMACPI	
BoCoV	--KSDFLQPV	YASYKVLONG	VIRDVSVEDV	CFANKFEQFD	QWYESTFGLS	YYSNSMACPI	
MHV	--KSDMLQPL	YASFYKVLONG	VLRDVTVTD	CFANKFIQFD	QWYESTFGLV	YYRNSRACPV	
AIPV	PMYDVNSTLH	VEGFYKVIDG	VLRIVPEDT	CFSNKFVNFD	AFWG----	YDNSR-NCPI	
SARS CoV	--IHDGYTNE	IIGYKAIQDG	VTRDIISTDD	CFANKHAGFD	AWFSQGGSY	KNDKS--CPV	

	3125 3135 3145 3155 3165 3175
EMCR	VVG---VSEI INVVPVPTN VYLVG-----KTLV FTLQAAFGNT GVCYDFDGV
229E	VVG---VSEI VNTVAGIPSN VYLVG-----KTLI FTLQAAFGNA GVCYDIFGV
PEDV	VVG---VSDE ARTVPGIPAG VYLAG-----KTLV FAINTIFGTS GLCFDASGVA
TGEV	VVGTVFDLEN MRPIPDVPAY VSIVG-----RSLV FAINAAGVNT NMCYDHTGNA
OC43	VVA-VIDQDF GSTVFNVPVK VLRYG-----YHVL HFITHALSAD GVQCYTPHSG
BoCoV	VVA-VVDQDF GSTVFNVPVK VLRYG-----YHVL HFITHALSAD GVQCYTPHSG
MHV	VVA-VIDQDI GYTLENVPVK VLRYG-----FHVH HFITHAFATD SVQCYTPHMQ
AIPV	VTA-VIDGD GTVATGVPGF VSWVMDGVMF IHMTQTERKP WYIPTWFNRE IVGYTQDSII
SARS CoV	VAA-IITREI GFIVPGLPGT VLRAIN-----GDFL HFLPRVFSAV GNICYTPSKL

	3185 3195 3205 3215 3225 3235
EMCR	TS-----DK CIFNSACTRL EGLGGD-NVY CYN-TDLIEG SKPYSILOPN AYYKYDVKN-
229E	TP-----EK CIFTSACTRL EGLGGN-NVY CYN-TALMEG SLPYSSIQAN AYYKYDNGN-
PEDV	DK-----GA CIFNSACTRL SGLGGT-AVY CYK-NGLVEG AKLYSELAPH SYXKMDGN-
TGEV	VSXD-SYFDT CVFNACTTTL TGLGGT-IVY CAK-OGLVEG AKLYSDLMPD YYEHAAGN-
OC43	ISYSNFYASG CVLSSACTMF TMADGSPQPY CYT-EGLMQN ASLYSSLVPH VRYNLANAKG
BoCoV	ISYSNFYASG CVLSSACTMF AMADGSPQPY CYT-DGLMQN ASLYSSLVPH VRYNLANAKG
MHV	IPYDNFYASG CVLSSACTML AHADGTPHPY CYT-EGIMHN ASLYDSLAPH VRYNLANSG
AIPV	TEG-SFYTSI ALFSARCLYL TASNTP-QLY CFNGDNDAPG ALPFGSIIPH RVYFQPNGVR
SARS CoV	IEYSDFATSA CVLAAECTIF KDAMGKVPY CYD-TNLLEG SISYSELAPD TRYVLMDS-

	3245 3255 3265 3275 3285 3295
EMCR	YVRFPEILAR GFGLRTIRTL ATRYCRVGE C RDSHKGVCFG FDKWYVNDGR VD---DGYIC
229E	FIKLPEVIAQ GFGRFTVRTI ATRYCRVGE C VESNAGVCFG FDKWFVNDGR VA---NGYVC
PEDV	AVSLPEIISR GFGRITIRTK AMTYCRVGQC VQSAEGVCFG ADRFFVYNAE SG---SDFVC
TGEV	MVKLPAIIR- GLGLRFVKTQ ATTYCRVGE C IDSAGKFCFG GONWFVYDNE FG---NGYIC
OC43	FIRFPEVLRE GL-VRIVRTR SMSYCRVGLC EEADEGICFN FNGSWVLNND YYRSLPGTFC
BoCoV	FIRLPEVLRE GL-VRIVRTR SMSYCRVGLC EEADEGICFN FNGSWVLNND YYRSLPGTFC
MHV	YIRFPEVSE GI-VRIVRTR SMTYCRVGLC EDAEEGVCFN FNSSWVLNND YYRAMPGTFC
AIPV	LIVPQQILHT PY---VVKFV SDSYCRGSVC EYTRPGYCVS LNPQWVLEND EYTSKPGVFC
SARS CoV	LIQFPNTYLE GS-VRVVTF DAECYCRHGC ERSEVGICLS TSGRWVLNNE HYRALSGVFC

	3305 3315 3325 3335 3345 3355
EMCR	GDGLIDLNVN VLSIFSSSFS VVAMSGHMLF NFLFAAFITF LCFLVTKFKR VFGDLSYGVF
229E	GTGLWNLVEN ILSMFSSSFS VVAMSGQILL NCALGAFATF CCFLVTKFKR MFGDLSVGVF
PEDV	GTGLFTLLMN VISVFSTKTP VTVLSGQILF NCIIAFVAVA VCFLETKFKR MFGDMSVGVF
TGEV	GNSVLGFFKN VEKLFNSNMS VVATSGAMLV NIIIACLAIA MCYGVLEKFK IFGDOCTFLV
OC43	GROVFDLIYQ LFKGLAQPDV FLALTASSIA GAILAVIVVL VFYLLIKLKR AFGDYTSVVF
BoCoV	GROVFDLIYQ LFKGLAQPDV FLALTASSIA GAILAVIVVL GFYLLIKLKR AFGDYTSVVF
MHV	GRNAFDLIHQ VLGGLVRPID FFALTASSVA GAILAIIIVL AFYLLIKLKR AFGDYTSVVV
AIPV	GSTVRELMFS MVSTFTTGVN -PNIYMLAT MFLILVVVVL IFAMVIKFOG VFKAAYATVF
SARS CoV	GV DAMMLIAN IFTPLVQPVG ALDVSAASVA GGIIAILVTC AAYTFMKFRR VFGEYNHVVA

	3365 3375 3385 3395 3405 3415
EMCR	TVVCATLINN ISYVVTON-L FFMILYAILY FVFTRTVR-- YAWIWHIAYI VAYFLLIPWW
229E	TVVAVLLNN VSYIVTON-L VTMIAYAILY FFATRSR-- YAWIWCAAYL IAYISFAPWW
PEDV	TVGACTLLNN VSYIVTON-T LGMLGYATLY FLCTKGVR-- YMWIWHLGFL ISYILTAPWW
TGEV	MIIVTLVNN VSYFVTQN-T FFMIIYAIVY FYITRKL-- YPGILDAGFI IAYINMAPWY
OC43	VNVIVWCNMF MMLFVQVYP ILSCVYAICY FYATLYFPSE ISVIMHLQWL VMYGTIMPLW
BoCoV	VNVIVWCNMF MMLFVQVYP TLSCVYAICY FYATLYFPSE ISVIMHLQWL VMYGTIMPLW
MHV	VNVIVWCNMF LMLFVQVYP TLSCLYACFY FYTLYFPSE ISVVMHLQWL VMYGAIMPWW
AIPV	ITMLVWVINA FILCVHSYNS VLAIVLLVLY CYASLVTSRN TVIIMHCWLV FTFLIVPTW
SARS CoV	ANALLFLMSF TILCLVPAYS FLPGVYSVY LYLTFTYTND VSFLAHLQWF AMFSPVPPW

	3425 3435 3445 3455 3465 3475
EMCR	LLTWFSFAAF LELLPNVFKL K----ISTQL FEGDKFIGTF ESAAAGTFVL DMRSYERLIN
229E	LCAWYFLAML TGLLPSLLKL K----VSTNL FEGDKFVGTF ESAAAGTFVI DMRSYEKLAN
PEDV	VLWVYAFSAI FEEMPNLFKL K----VSTQL FEGDKFVGTF ENAAAGTFVL DMHAYERLAN
TGEV	VITAYILVFL YDSLPSLFLK K----VSTNL FEGDKFVGTF ESAAAGTFVI DMRSYETIVN
OC43	FCLLYIAVVV SN--HAFWVF S----YCRKL GTSVRSOGTF EEMALTTFMI TKDSYCKLKN
BoCoV	FCLLYISVVV SN--HAFWVF S----YCRQL GTSVRSOGTF EEMALTTFMI TKDSYCKLKN
MHV	FCIIYVAVVV SN--HALWLF S----YCRKL GTEVRSOGTF EEMSLTTFMI TKESYCKLKN
AIPV	LACCYLGFII YMYTPLFLWC YGTTKNTKRL YDGNFVGNV DLAASKTFVI RGSEFVKLTN
SARS CoV	ITAIYVFCIS LKHCHWFENN Y----LRKRV MFNGVTFTST EEAALCTFLL NKEMYLKLR

	3485 3495 3505 3515 3525 3535
EMCR	T--ISPEKLK NYAASYNKYK YSGSASEAD YRCACYAHLA KAMLDYAKDH N-DMLYSPPT
229E	S--ISPEKLK SYAASYNRYK YSGNANEAD YRCACYAYLA KAMLDYARDH N-DILYTPPT
PEDV	S--ISTEKLK QYASTYNKYK YSGSASEAD YRLACFAHLA KAMMDYASNN N-DTLYTPPT
TGEV	S--TSIARIK SYANSFNKYK YTGSMGEAD YRMACYAHLG KALMDYSVNR T-DMLYTPPT
OC43	S--LSDVAFN RYLSLYNKYR YSGKMDTAA YREAACSQA KAMDTFTNNN GSDVLYQPPT
BoCoV	S--LSDVAFN RYLSLYNKYR YSGKMDTAA YREAACSQA KAMDTFTNNN GSDVLYQPPT
MHV	S--VSDVAFN RYLSLYNKYR YSGKMDTAA YREAACSQA KAMDTFTNNN GNDVLYQPPT
AIPV	E--I-GDKFE AYL SAYARKL YSGTGSEQD YLOACRAWLA YALDQYR-NS GVEIVYTPPR
SARS CoV	ETLLPLTQYN RYLAALNKYK YFGALDTS YREAACCHLA KALNDFS-NS GADVLYQPPT

	....|....|....|....|....|....|....|....|	3545	3555	3565	3575	3585	3595
EMCR	ISYN-STLQS	GLKKMAQPSG	CVERCVVRVC	YGSTVLNGVM	LGDTVTCPRH	VIAPS-TTVL	
229E	VSYG-STLQA	GLRKMAQPSG	FVEKCVVRVC	YGNTVLNGLW	LGDIVYCPRH	VIASN-TTSA	
PEDV	VSYN-STLQA	GLRKMAQPSG	VVEKCVVRVC	YGNMALNGLW	LGDIVMCPRH	VIASS-TTST	
TGEV	VSVN-STLQS	GLRKMAQPSG	LVEPCIVRVS	YGNVVLNGLW	LGDEVICPRH	VIASD-TTRV	
OC43	ASVSTSFLOS	GIVKMVNPTS	KVEPCVSVT	YGNMTLNGLW	LDDKVYCPRH	VICSSADMTN	
BoCoV	ASVSTSFLOS	GIVKMVNPTS	KVEPCIVSVT	YGNMTLNGLW	LDDKVYCPRH	VICSSADMTN	
MHV	ASVSTSFLOS	GIVKMVFPTS	KVEPCVSVT	YGNMTLNGLW	LDDKVYCPRH	VICSSADMTD	
AIPV	YSIGVSRLOS	GFKKLVSPPS	AVEKCVSVS	YRGNLNLGLW	LGDTIYCPRH	VLG---KFSG	
SARS CoV	TSITSAVLQS	GFRKMAFPSG	KVEGCMVQVT	CGTTTLNGLW	LDDTVYCPRH	VICTAEDMLN	
	....|....|....|....|....|....|....|....|	3605	3615	3625	3635	3645	3655
EMCR	IDYDHAYSTM	RLHNFSVSHN	G-VFLGVVGV	TMHGSVLRIK	VSQSNVHTPK	HVFRTLKPGA	
229E	IDYDHEYSIM	RLHNFSIISG	T-AFLGVVGA	TMHGVTLKIK	VSQTNMHTPR	HSFRTLKSGE	
PEDV	IDYDIALSVL	RLHNFSIISG	N-VFLGVVSA	TMRGALLQIK	VNQNNVHTPK	YTYRTVRPGE	
TGEV	INYENEMSSV	RLHNFSVSKN	N-VFLGVVSA	RYKGVNLVLK	VNQVNPTPE	HKFKSIKAGE	
OC43	PDYTNLLCRV	TSSDFTVLFD	R-LSLTVMYS	QMRGCMVLVT	VTLQNSRTPK	YTFGVVVKPGE	
BoCoV	PDYTNLLCRV	TSSDFTVLFD	R-LSLTVMYS	QMRGCMVLVT	VTLQNSRTPK	YTFGVVVKPGE	
MHV	PDYTNLLCRV	ISSDFCVMSG	R-MSLTVMYS	QMQGSLVLVT	VTLQNPNTPK	YSFGVVVKPGE	
AIPV	DQWNDVLNLA	NNHEFEVTTQ	HGVTLMVSR	RLKGAVLILQ	TAVANAETPK	YKFIKANCOD	
SARS CoV	PNYEDLLIRK	SNHSFLVQAG	N-VQLRVIGH	SMQNCLLRK	VDTSNPKTPK	YKFVRIQPGQ	
	....|....|....|....|....|....|....|....|	3665	3675	3685	3695	3705	3715
EMCR	SFNILACYEG	IASGVFVGNL	RTNFTIKGSF	INGACGSPGY	NVRNDGTVEF	CYLHQIELGS	
229E	GENILACYDG	CAQGVFVGNM	RTNWTIRGSF	INGACGSPGY	NLKN-GEVEF	VYMHQIELGS	
PEDV	SFNILACYDG	AAAGVYGVNM	RSNYTIRGSF	INGACGSPGY	NINN-GTVEF	CYLHQIELGS	
TGEV	SFNILACYEG	CPGSVYGVNM	RSQGTIKGSF	IAGTCGSVGY	VLEN-GILYF	VYMHLELGN	
OC43	TFTVLAAYNG	KPQGAHFVTM	RSSYTIKGSF	LCGSCGSVGY	VIMG-DCVKF	VYMHQLELST	
BoCoV	TFTVLAAYNG	KPQGAHFVTM	RSSYTIKGSF	LCGSCGSVGY	VIMG-DCVKF	VYMHQLELST	
MHV	TFTVLAAYNG	KSQGAHFVTM	RSSYTIKGSF	LCGSCGSVGY	VLTG-DSVRF	VYMHQLELST	
AIPV	SFTIACAYGG	TVVGLYPVTM	RSNGTIRASF	LAGACGSVGF	NIEK-GVVNF	VYMHLELPTN	
SARS CoV	TFSVLACYNG	SPSGVYQCAM	RPNHTIKGSF	LNGSCGSVGF	NIDY-DCVSF	CYMHMELPT	
	....|....|....|....|....|....|....|....|	3725	3735	3745	3755	3765	3775
EMCR	GAHVGSDFTG	SVYGNFDDQP	SLQVESANLM	LSDNVVAFLY	AALNGCR--	----WWLRST	
229E	GSHVGSDFDG	VMYGGFEDQP	NLQVESANQM	LTNVVVAFLY	AALNGCT--	----WWLKGE	
PEDV	GCHVGSDDLQ	VMYGGYEDQP	TLQVEGASSL	FTENVLAFLY	AALINGST--	----WWLSSS	
TGEV	GSHVGSNFEG	EMYGGYEDQP	SMQLEGTNVM	SSDNVVAFLY	AALINGER--	----WFTVNT	
OC43	GCHTGTDENG	DFYGPYKDAQ	VVQLLIQDYI	QSVNFVAWLY	AAILNNCN--	----WVQSD	
BoCoV	GCHTGTDENG	DFYGPYKDAQ	VVQLPVQDYI	QSVNFVAWLY	AAILNNCN--	----WVQSD	
MHV	GCHTGTDENG	NFYGPRYDAQ	VVQLPVQDYT	QTVNVVAWLY	AAILNRNC--	----WVQSD	
AIPV	ALHTGTDLMG	EFYGGYVDEE	VAQRVPPDNL	VTNNIVAWLY	AAISVKRESS	FSLPKWLEST	
SARS CoV	GVHAGTDLEG	KFYGPFVDRQ	TAQAAGTDTT	ITLNVLAWLY	AAVINGDR--	----WFLNRF	
	....|....|....|....|....|....|....|....|	3785	3795	3805	3815	3825	3835
EMCR	RVNVDFGNEW	AMANGYTIVS	SV--ECYSIL	AAKTGVSVVEQ	LLASIQHLHE	-GFGGKNILG	
229E	KLFEVHYNEW	AQANGFTAMN	GE--DAFSIL	AAKTGVCVCE	LLHAIQVLNN	-GFGGKQLLG	
PEDV	RIAVDRFNEW	AVHNGMTTVG	NT--DCFSIL	AAKTGVVDQR	LLASIQSLHK	-NFGGKQLLG	
TGEV	SMSLESYNTH	AKTNSFTELS	ST--DAFSML	AAKTGQSVEK	LLDSIVRLNK	-GFGGRTILS	
OC43	KCSVEDFNWV	ALSNGFSQVK	SD--LVIDAL	ASMTGVSLET	LLAAIKRLKN	-GFGGRQIMG	
BoCoV	KCSVEDFNWV	ALSNGFSQVK	SD--LVIDAL	ASMTGVSLET	LLAAIKRLKN	-GFGGRQIMG	
MHV	SCSLEEFNVW	AMTNGFSSIK	AD--LVLDAL	ASMTGVTVEQ	LLAAIKRLYS	-GFGGKQLLG	
AIPV	TVSVDDYNKW	AGDNGFTPPS	TS--TAITKL	SAITGVDDCK	LLRTIMVKNS	-QWGGDPILG	
SARS CoV	TTTLDNFNLV	AMKYNYEPLT	QDHVDILGPL	SAQTGIAVLD	MCAALKELLQ	NGMNGRTILG	
	....|....|....|....|....|....|....|....|	3845	3855	3865	3875	3885	3895
EMCR	YSSLCDEFTL	AEVVQMYGV	NLQSGK---V	IFGLKTMFLF	SVFMTFWAE	LFYITNTIWI	
229E	YSSLNDEFSI	NEVVQMFQGV	NLQSGK---T	TSMFKSISLF	AGFFVMFWAE	LFVYTTTIWV	
PEDV	HTSLTDEFTT	GEVVQMYGV	NLQGGY---V	SRACRNVLV	GSLTFWFSE	LVSYTKFFWV	
TGEV	YGSLCDEFTP	TEVIRQMYGV	NLQAGK---V	KSFFYPIMTA	MTILFAFWLE	FMYTPPTWI	
OC43	SCSFEDELTP	SDVYQQLAGI	KLQSKRTRLF	KGTVCWIMAS	TFLFSCIITA	FVKWTMFMVY	
BoCoV	SCSFEDELTP	SDVYQQLAGI	KLQSKRTRLV	KGTVCWIMAS	TFLFSCIITA	FVKWTMFMVY	
MHV	SCVLEDELTP	SDVYQQLAGV	KLQSKRTRVV	KGTCCWILAS	TLLFSCIISA	FVKWTMFMVY	
AIPV	QYNFEDELTP	ESVFNQIGGV	RLQSSFVR--	K--ATSWFWS	RCVLACFLFV	LCAIVLFTAV	
SARS CoV	STILEDEFTP	FDVVQRCSGV	TFQGFKKIV	KGTHHWMLLT	FLTSLILVQ	STQWSLFFV	
	....|....|....|....|....|....|....|....|	3905	3915	3925	3935	3945	3955
EMCR	NPVILTPIFC	LLLFLSLVLT	MFLKHKFLFL	QVFLLPVIA	TALYNC-VLD	YYIVKFLADH	
229E	NPGLTTPFMI	LLVALSLCLT	FVVKHKVLF	QVFLPSIIV	AAIQNC-AWD	YHVTKVLAEK	
PEDV	NPGVVTPMFA	CLSLSSLLM	FTLKHKTLLF	QVFLIPALIV	TSCINL-AFD	VEVYNYLAEH	
TGEV	NPTFVSIVLA	VTTLISTVVF	SGIKHKMLFF	MSFVLPVIL	VTAHNL-FWD	FSYYESLQSI	
OC43	TTNMFSITFC	ALCVIS-LAM	LLVKKHKLVL	TMVITP-VLF	TLLYNN-YLV	VYKHTFRGYV	
BoCoV	TTNMFSITFC	ALCVIS-LAM	LLVKKHKLVL	TMVITP-VLF	TLLYNN-YLV	VYKHTFRGYV	
MHV	TTMLGLVTL	ALCFVS-FAM	LLVKKHKLVL	TMFIMP-VLC	TLEYTN-YLV	VYKQSFRLGA	
AIPV	PLKFYVYAAV	ILLMAVLFIS	FTVKHVMAYM	DTFLPTLIT	VIIGVCAEVP	FIYNTLISQV	
SARS CoV	YENAFPLPFTL	GIMAIAACAM	LLVKKHKAFL	CLFLLPSLAT	VAYFN---MV	YMPASVWMRI	

	3965	3975	3985	3995	4005	4015
EMCR	FN-YNVSVLQ	MDVQGLVNV	VCLFVVFLH-	--TWRFSEK	ETHWETVYCS	LIAYATYFY
229E	FD-YNVSVMQ	MDIQGFVNIF	ICLFVALLH-	--TWRFSEK	CTHWCTYLF	LIAYLYTALY
PEDV	FD-YHVSMLG	FNAQGLVNI	VCFFVTLHG	TYTWRFEN-T	PASSVTVYVA	LLTAAYNYFY
TGEV	VENTNTMFLP	VDMQGVMLTV	FCFIVFVTVS	VRFFTCQKSW	FSLAVTTILV	IFNMVKIFGT
OC43	YAWLSYVPS	VEYTYTDEVI	YGMILLVGMV	FVTLRSINHD	LFSFIMFVGR	LISVFSMLWK
BoCoV	YAWLSYVPS	VEYTYTDEVI	YGMILLVGMV	FVTLRSINHD	LFSFIMFVGR	VISVSLWYM
MHV	YAWLSHFVPA	VDYTYMDEV	YGVVLLVAMV	FVTMRSINHD	VFSVMFLVGR	LVSLSMWFY
AIPV	VIFLSQWYDP	VVFDTMVPWM	FLPLVLYTAF	KCVQGCYMS	FNTSLMLLYQ	FVKLGFIYIT
SARS CoV	MTWLELADTS	LSGYRLKDCV	MYASALVLLI	LMTARTVYDD	AARRVWTLMN	VITLVYKVVY

	4025	4035	4045	4055	4065	4075
EMCR	SGD-----	FLSL	LVMFLCAISS	DWYIGAIVFR	LSRLIIFESP	E---SVFSVF
229E	SYD-----	YVSL	LVMLLCAISN	EWYIGAIIFR	ICRFGVAFLP	V---EYVSFY
PEDV	ASD-----	ILSC	AMTLFASVTG	NWFGVAVCYK	VAVYMALRFP	----TFVAIF
TGEV	SDEPWTENQI	AFCFVNM	LTMIIVSLTTK	DWMVVIASYS	IAYYIVVCVM	P-S-AFVSDF
OC43	GSN-----	LEEEI	LLMLASLFGT	YTWTTVLSMA	VAKVIKAWA	VNV-LYFTDI
BoCoV	GSN-----	LEEEI	LLMLASLFGT	YTWTTVLSMA	VAKVIKAWA	VNV-LYFTDI
MHV	GAN-----	LEEEV	LLFLTSLSFGT	YTWTTMLSLA	TAKVIKAWA	VNV-LYFTDV
AIPV	SSNTLTAYTE	GNWELFFELV	HTTVLANVSS	NSLIGLFVFK	CAKWMLYYCN	-----ATYL
SARS CoV	GNALD-----	QAISM	WALVISVTSN	YSGVVTTIME	LARAIVFVCV	EYYPPLFITG

	4085	4095	4105	4115	4125	4135
EMCR	GDVKLTLLVY	LICGVLCTY	WGILYWFNRF	FKCTMGVYDF	KVSAAEFKYM	VANGLHAPYG
229E	DGVKTVLLFY	MLLGEVSCMY	YGLLYWINRF	CKCTLGVDYF	CVSPAEEFKYM	VANGLNAPNG
PEDV	GDIKSVMFY	LVLGYFTCCF	YGILYWFNRF	FKSVGVYDY	TVSAAEFKYM	VANGLRAPTG
TGEV	GFMKCISIVY	MACGYLFCCY	YGILYWFNRF	TCMTCGVYQF	TVSAAELKYM	TANNLSAPKN
OC43	PQIKIVLLCY	LFIGYIISCY	WGLFSLMNSL	FRMPLGVYNY	KISVQELRYM	NANGLRPPKN
BoCoV	PQIKIVLVY	LFIGYIISCY	WGLFSLMNSL	FRMPLGVYNY	KISVQELRYM	NANGLRPPKN
MHV	PQVKLVLLSY	LCIGYVCCCY	WGLVSLLSNI	FRMPLGVYNY	KISVQELRYM	NANGLRPPRN
AIPV	NNYVLMAMV	NCIGWLCTCY	FGLYVWVNVK	FGLTLGKYNF	KVSDVQYRYM	CLHKNPPKT
SARS CoV	NTLQICMLVY	CFLGYCCCCY	FGLFCLLNRY	FRLTLGVYDY	LVSTQEFRYM	NSQGLLPPKS

	4145	4155	4165	4175	4185	4195
EMCR	PFDALWLSFK	LLGIGGDRCI	KISTVQSKLT	DLKCTNVVLL	GCLSSMNIAA	NSSEWAYCVD
229E	PFDALFLSFK	LMGIGGPRTI	KVSTVQSKLT	DLKCTNVVLM	GILSNMNIAS	NSKEWAYCVE
PEDV	TLDLSLLSAK	LIGIGGERNI	KISSVQSKLT	DIKCSNVVLL	GCLSSMNVSA	NSTEWAYCVD
TGEV	AYDAMILSAK	LIGVGGKRN	KISTVQSKLT	EMKCTNVVLL	GLLSKMHVES	NSKEWNYCVG
OC43	SFEALMLNFK	LLGIGGVPII	EVSQFQSKLT	DVKCANVLL	NCLQHLHVAS	NSKLWHYCST
BoCoV	SFEALMLNFK	LLGIGGVPII	EVSQFQSKLT	DVKCANVLL	NCLQHLHVAS	NSKLWHYCST
MHV	SFEALVLFNK	LLGIGGVPII	EVSQFQSKLT	DVKCANVLL	NCLQHLHVAS	SSKLWHYCST
AIPV	VVEVFSTNIL	IQGIGGDRVL	PIATVQAKLS	DVKCTTVVLM	QLLTCLNVEA	NSKMHVYLVE
SARS CoV	SIDAFKLNK	LLGIGGKPCI	KVATVQSKMS	DVKCTSVVLL	SVLQQLRVES	SSKLWMAQCVO

	4205	4215	4225	4235	4245	4255
EMCR	LHNKINLCDD	PEKAQGMLLA	LLAFFLSKHS	DFG-----L	DGLIDSYFDN	SSTLQSVASS
229E	MHNKINLCDD	PETAQELLLA	LLAFFLSKHS	DFG-----L	GDLVDSYFEN	DSILQSVASS
PEDV	LHNKINLCND	PEKAQEMLLA	LLAFFLSKNS	AFG-----L	DDLLESYFND	NSMLQSVAST
TGEV	LHNEINLCDD	PEIVLEKLLA	LLAFFLSKHN	TCD-----L	SELIESYFEN	TTILQSVASA
OC43	LHNEILATSD	LSVAFERLAQ	LLIVLFANPA	AVDSKCLTSI	EEVCDYAKD	NTVLQALQSE
BoCoV	LHNEILATSD	LGVAFERLAQ	LLIVLFANPA	AVDSKCLTSI	EEVCDYAKD	NTVLQALQSE
MHV	LHNEILATSD	LSVAFERLAQ	LLVVLFFANPA	AVDSKCLASI	EEVSDDYVRD	STVLQALQSE
AIPV	LHNKILASDD	VGECMDNLLG	MLITLFCIDS	TID-----L	SEYCDILKR	STVLQSVTQE
SARS CoV	LHNDILAKD	TTEAFKRMVS	LLSVLLSMQG	AVD-----I	NRLCEEMLDN	RATLQAIASE

	4265	4275	4285	4295	4305	4315
EMCR	FVSMPSYIAY	ENARQAYEDA	IANGSS----	SQLIKQLKRA	MNIASEFDH	EISVQKKINR
229E	FVGMPSFVAY	ETARQYENYA	VANGSS----	PQIIKQLKKA	MNVAKAEFDR	ESSVQKKINR
PEDV	YVGLPSYVIY	ENARQYQYEDA	VNNGSP----	PQLVKQLRHA	MNVAKSEFDR	EASTQKLLDR
TGEV	YAALPSWIAL	EKARADLEEA	KKNDSV----	PQILKQLTKA	FNIASDFFER	EASVQKKLDR
OC43	FVNMAFVEY	EVAKKNLDEA	RFGSGAN----	QQQLKQLEKA	CNIASAYER	DRAVAKKLER
BoCoV	FVNMAFVEY	EVAKKNLDEA	RFGSGAN----	QQQLKQLEKA	CNIASAYER	DRAVAKKLER
MHV	FVNMAFVEY	ELAKKNLDEA	KASGSAN----	QQIKQLEKA	CNIASAYER	DRAVAKKLER
AIPV	FSHIPSYAEY	ERAKNLYEKV	LVDSKNGGVT	QQELAARYKA	ANIASKVDFR	DLAVQKKLDS
SARS CoV	FSSLPSYAA	ATAQAYEQA	VANGDS----	EVVLKLLKKS	LNVAKSEFDR	DAAMQKLEK

	4325	4335	4345	4355	4365	4375
EMCR	MAEQAAQMY	KEARSVNRKS	KVISAMHSL	FGMLRRLDMS	SVETVLNLAR	DGVVPLSVIP
229E	MAEQAAAQMY	KEARAVNRKS	KVISAMHSL	FGMLRRLDMS	SVDTILNMAR	NGVPLSVIP
PEDV	MAEQAAAQMY	KEARAVNRKS	KVISAMHSL	FGMLRRLDMS	SVDTILNLAK	DGVVPLSVIP
TGEV	MAEQAAASMY	KEARAVDRKS	KIVSAMHSL	FGMLKRLDMS	SVNTIIDQAR	NGVPLSLIIP
OC43	MADLALTNY	KEARINDKKS	KVVSALQTML	FSMVRKLQND	ALNSILDNAV	KGCVPPLNAIP
BoCoV	MADLALTNY	KEARINDKKS	KVVSALQTML	FSMVRKLQND	ALNSILDNAV	KGCVPPLNAIP
MHV	MADLALTNY	KEARINDKKS	KVVSALQTML	FSMIRKLQND	ALNSILDNAV	KGCVPPLNAIP
AIPV	MAERAMTNY	KEARVTDRA	KLVSSLHALL	FSMLKKIOSE	KLNVLFQDAS	SGVPLATVP
SARS CoV	MADQAMTNY	QARSEDKRA	KVTSAMQTML	FTMLRKLQND	ALNNIINNAR	DGCVPPLNIIP

	4385	4395	4405	4415	4425	4435
EMCR	ATSASKLTIV	SPDLESYSKI	VCDGSVHYAG	VVWTLNDVKD	NDGRPVHVKE	ITR-----EN
229E	ATSARLVVV	VPDHSFVKM	MVDGCVHYAG	VVWTLQEVKD	NDGKNVHLKD	VTK-----EN
PEDV	AVSATKLNIV	TSDIDSYNRI	QREGCVHYAG	TIWNIIDIKD	NDGKVHVHKE	VTA-----QN
TGEV	AASATRLVVI	TPSLEVFSKI	RQENNVHYAG	AIWTIVEVKD	ANGSHVHLKE	VTA-----AN
OC43	SLAANTLNII	VPDKSVYDQV	VDNVVVTYAG	NVWQIQTIQD	SDGTNKQLNE	IS-----
BoCoV	SLAANTLTII	VPDKSVYDQV	VDNVVVTYAG	NVWQIQTIQD	SDGTNKQLHE	IS-----
MHV	SLTSNTLTII	VPDKQVFDQV	VDNVVVTYAG	NVWHIQSIQD	ADGAVKQLNE	ID-----
AIPV	IVCSNKLTIV	IPDPETWVRC	VEGVHVTYST	VVWNIDTVID	ADGTELHPTS	TGSGLTTCIS
SARS CoV	LTTAAKLWV	VPDYGTYNK	CDGNTFTYAS	ALWEIQQVVD	ADSKIVQLSE	INM-----DN

	4445	4455	4465	4475	4485	4495
EMCR	VETLTWPLIL	NCER-----	VVKLQNNNEIM	PGKLRQKFMK	AEG--DGGVL	GDGNALYNTE
229E	QEILVWPLIL	TCER-----	VVKLQNNNEIM	PGKMKVKATK	GEG--DGGIT	SEGNALYNNE
PEDV	AESLSWPLVL	GCER-----	IVKLQNNNEII	PGKLRQRSIK	AEG--DG-IV	GEGKALYNNE
TGEV	ELNLTWPLSI	TCER-----	TTKLQNNNEIM	PGKLRKRAVR	ASATLDGEAF	GSGLKALMASE
OC43	-DDCNWPLVI	IANRY-NEVS	ATVLQNNNELM	PAKLKIQVNV	SGP--DQTCN	TPTQCYNNNS
BoCoV	-DDCNWPLVI	IANRH-NEVS	ATVLQNNNELM	PAKLKTQVNV	SGP--DQTCN	TPTQCYNNNS
MHV	-VNITWPLVI	AANRH-NEVS	SVVLQNNNELM	PQKLRQVNV	SGS--DMNCN	TPTQCYNTT
AIPV	GANTAWPLKV	NLTRNGHNV	DVVLQNNNELM	PHGVKTACV	AGVD-QAHCS	VESKCYNTNI
SARS CoV	SPNLAWPLIV	TALRA-N--S	AVKLQNNNELS	PVALRQMSCA	AGTTQTACTD	DNALAYNNNS

	4505	4515	4525	4535	4545	4555
EMCR	GGKTFMYAYI	SNKADLKFKV	WEY-EGG-CN	TIELDSPCRF	MVETPNGPQV	KYLYFVKNLN
229E	GGRAFMYAYV	TTKPGMKYVK	WEH-DSG-VV	TVELEPPCRF	VIDTPTGPQI	KYLYFVKNLN
PEDV	GGRTFMYAFI	SDKPDLRVVK	WEF-DGG-CN	TIELEPPRKF	LVDSPNGAQI	KYLYFVRNLN
TGEV	SGKSFMYAFI	ASDNNLKYYK	WES-NND-II	PIELEAPLRF	YVDGANGPEV	KYLYFVKNLN
OC43	NNGKIVYAIL	SDVDGLKYTK	ILKDDGN-FV	VLELDPPCKF	TVQDAKGLKI	KYLYFVKGCN
BoCoV	YNGKIVYAIL	SDVDGLKYTK	ILKDDGN-FV	VLELDPPCKF	TVQDVKGLKI	KYLYFVKGCN
MHV	GMGKIVYAIL	SDCDGLKYTK	IVKEDGN-CV	VLELDPPCKF	SVQDVKGLKI	KYLYFVKGCN
AIPV	SGNSVVAAIT	SSNPNLKVAS	FLNEAGN-QI	YVDLDPPCKF	GMKVGKVEV	VYLYFIKNTN
SARS CoV	KGGRFVLALL	SDHQDLKWAR	FPKSDGTGTI	YTELEPPCRF	VTDTPKGPKV	KYLYFIKGLN

	4565	4575	4585	4595	4605	4615
EMCR	TLRRGAVLGF	IGATVRLQAG	-KQTELVANS	GLLTACAFSV	DPATTYLEAV	KHGAKPVNSC
229E	NLRRGAVLGY	IGATVRLQAG	-KQTEFVSNS	HLLTHCSFAV	DPAAAYLDAV	KQGAAPVGN
PEDV	TLRRGAVLGY	IGATVRLQAG	-KQTEQAINS	SLLTLCAFAV	DPAKTYIDAV	RSCHKPVGN
TGEV	TLRRGAVLGY	IGATVRLQAG	-KPTEHPSNS	SLLTLCAFSV	DPKAYVDAV	KRGMPVNNC
OC43	TLARGVWVGT	ISSTVRLQAG	-TATEYASNS	SILSLCAFSV	DPKKTLYLDFI	QGGTPIANC
BoCoV	TLARGVWVGT	ISSTVRLQAG	-TATEYASNS	SILSLCAFSV	DPKKTLYLDFI	QGGTPIANC
MHV	TLARGVWVGT	LSSTVRLQAG	-TATEYASNS	AIRSLCAFSV	DPKKTLYLDYI	QGGAPVTNC
AIPV	SIVRGMYLGA	ISNVVVLQSK	GHETEEDAV	GILSLCSFAV	DPADTYCKYV	AAGNQPLGNC
SARS CoV	NLNRGMVLGS	LAATVRLQAG	-NATEVPANS	TVLSFCFAV	DPKAYKDYL	ASGGQPIANC

	4625	4635	4645	4655	4665	4675
EMCR	IKMLNSGAGN	GQAITSVDA	NTNQDSYGGA	SICLYCRAHV	PHP---SMD	GCKFKGKCV
229E	VKMLTNGSGS	GQAITCTIDS	NTTQDTSYGA	SVCICYCRAHV	AHP---TMD	GFCQYKGGV
PEDV	VKMLANGSGN	GQAVTNGVEA	STNQDSYGGA	SVCICYCRAHV	EHP---SMD	GFCRLKGGV
TGEV	VKMLNSGAGN	GMAVTNGVEA	NTQDTSYGGA	SVCICYCRHV	EHP---AID	GLCRYKGGV
OC43	VKMLCDHAGT	GMAITVKPDA	TTSQDSYGGA	SVCICYCRARV	EHP---DND	GLCKLRGKFV
BoCoV	VKMLCDHAGT	GMAITVKPDA	TTSQDSYGGA	SVCICYCRARV	EHP---DND	GLCKLRGKFV
MHV	VKMLCDHAGT	GMAITIKPEA	TTNQDSYGGA	SVCICYCRSRV	EHP---DND	GLCKLRGKFV
AIPV	VKMLTVHNGS	GFAITSKPSP	TPDQDSYGGA	SVCICYCRAHI	AHPGVSNGLD	GRCQFKGSFV
SARS CoV	VKMLCTHTGT	GQAITVTPEA	NMDQESFPGA	SCCLYCRCHI	DHP---NPK	GFCDLKGGV

	4685	4695	4705	4715	4725	4735
EMCR	QVPIGCL-DP	IRFCLENNVC	NVCGCWLGHG	CACDRTTIQS	-----	-VDISYLNQ
229E	QVPIGCL-DP	IRFCLENTVC	KVCGCWLNGH	CTCDRTAIQS	-----	-FDNSYLNQ
PEDV	QVPLGTVD-DP	IRFVLENDVC	KVCGCWLNSG	CTCDRSIMQS	-----	-T-----
TGEV	QIPTGTQ-DP	IRFCIENVC	VVCGCWLNGG	CMCDRTSMQS	F-----	TVDSYLNQ
OC43	QVPVGK-DP	VSYVLTHDVC	RVCGFWRDGS	CSCVSTDTTV	Q-----	SKDT-----
BoCoV	QVPVGK-DP	VSYVLTHDVC	QVCGFWRDGS	CSCVSTDTTV	Q-----	SKDTNFGF
MHV	QVPLGK-DP	VSYVLTHDVC	QVCGFWRDGS	CSCVGTGSQF	Q-----	SKDTNFGF
AIPV	QIPTTEK-DP	VGFCRLNVC	TVCQCWIGYG	CQCDSLRQPK	SSVQSVAGAS	DFDKNYLNGY
SARS CoV	QIPTTCANDP	VGFTLRNTVC	TVCGMWKGYG	CSCDQLREPL	M-----	QSADASTFLN

	4745
EMCR	GVLVQLD
229E	GALVPLD
PEDV	-----
TGEV	GVLVQLD
OC43	-----
BoCoV	GVRV---
MHV	GVQV---
AIPV	GVAVRLG
SARS CoV	GFAV---

C. Putative orf 1b

	5	15	25	35	45	55
EMCR	-----	-----	RARGSSAARL	EPCN-GTDID	KCVRAFDIYN	KNVSFLGKCL
229E	-----	-----	-----	EPCN-GTDID	YCVRAFDVYN	KDASFIGKNL
PEDV	-----	-----	YGLFK RVRGSSAARL	EPCN-GTDTQ	HVYRAFDIYN	KDVACLKGFL
TGEV	-----	-----	-----	EPCN-GTDPD	HVSRAFDIYN	KDVACIGKFL
BoCoV	-----	-----	FFKR VRGTSVDARL	VPCASGLSTD	VQLRAFDICN	ASVAGIGLHL
OC43	-----	-----	FFKR VRGTSVDARL	VPCASGLSTD	VQLRAFDIYN	ASVAGIGLHL
MHV	LFLCRHRLPV	SVKRHELFKR	VRGTSVNARL	VPCASGLDTD	VQLRAFDICN	ANRAGIGLYY
AIPV	-----	-----	-----	-----	-----	MFQNL
SARS CoV	-----	-----	-----	TPCGTGTSTD	VVYRAFDIYN	EKVAGFAKFL
	65	75	85	95	105	115
EMCR	KMNCVRFKNA	-----DL	KDGYFVIKRC	TKSVMDEHQS	MYNLLNFSGA	LAEHDFFTWK
229E	KSNCVRFKNV	-----DK	DDAFYIVKRC	IKSVMDEHQS	MYNLLKGCNA	VAKHDFFTWH
PEDV	KVNCVRLKNL	-----DK	HDAFYVVKRC	TKSVMDEHQS	IYSRLEKCGA	IAEHDFFTWK
TGEV	KTNCSTRFNL	-----DK	HDAFYIVKRC	TKTVMDEHQS	CYNDLKDSCA	VAEHDFFTYK
BoCoV	KVNCCRFQRV	--DENG--DK	LDQFFVVKRT	DLTIYNREME	CYERVKDCRF	VAEHDFFTFD
OC43	KVNCCRFQRV	--DENG--DK	LDQFFVVKRT	DLTIYNREME	CYERVKDCRF	VAEHDFFTFD
MHV	KVNCCRFQRA	--DEEG--NT	LDKFFVIKRT	NLEVYNKEKE	CYELTKECGV	VAEHDFFTFD
AIPV	KRNCARFQEL	RTEDGNLEY	LDSYFVVKQT	TPSNYEHEKS	CYEDLKS-EV	TADHDFVFVN
SARS CoV	KTNCCRFQEK	--DEEG--NL	LDSYFVVKRH	TMSNYQHEET	IYNLVKDCPA	VAVHDFFKFR
	125	135	145	155	165	175
EMCR	DGRVIYGNVS	RHNLTRYTMM	DLVYAMRNF	EQNCQVLKEV	LVLTGCCDNS	----YFDSKG
229E	EGRTIYGNVS	RQDLTKYTMM	DLCPALRNF	EKDCQVFKKEI	LVLTGCCSTD	----YFEMKN
PEDV	DGRAIYGNVC	RKDLTKYTMM	DLCYALRNF	ENNCQVLKSI	LIKVGACEES	----YFNKVV
TGEV	EGRCFEGNVA	RHNLTRYTMM	DLCYAIRNF	EKNCQVLKEI	LVTVGACTEE	----FFENKD
BoCoV	VEGSRVPHIV	RKDLTKYTMM	DLCYALRNF	RNDCMLLCDI	LSIYAGCEQS	----YFTKKD
OC43	VEGSRVPHIV	RKDLTKYTMM	DLCYALRNF	RNDCMLLCDI	LSIYAGCEQS	----YFTKKD
MHV	VEGSRVPHIV	RKDLTKYTMM	DLCYALRNF	RNDCTLKEI	LLTYAECDES	----YFQKDD
AIPV	KN---IYNIS	RQRLTKYTMM	DFCYALRNF	PKDCQVLKEI	LVTYGCIEDY	HPKWFEENKD
SARS CoV	VDGDMVPHIS	RQRLTKYTMA	DLVYALRNF	EGNCQVLKEI	LVTYNCDDDD	----YFNKDD
	185	195	205	215	225	235
EMCR	WYDPVENEDI	HRVYASLGKI	VARAMLKCA	LCDAVMAKGV	VGVLTLDNQD	LNGNFYDFGD
229E	WFDPIENEDI	HRVYALGKV	VANAMLKCA	FCDEMVLKGV	VGVLTLDNQD	LNGNFYDFGD
PEDV	WFDPIENEDI	HRVYALLGTI	VARAMLKCA	FCDAVMEQGI	VGVLTLDNQD	LNGDFYDFGD
TGEV	WFDPIENEDI	HEVYAKLGPI	VANAMLKCA	FCDAIVEKGY	IGVITLDNQD	LNGNFYDFGD
BoCoV	WYDFVENPDI	INVYKKGPI	FNRLVLSATE	FADKLVEVGL	VGVLTLDNQD	LNGKWDYDFGD
OC43	WYDFVENPDI	INVYKKGPI	FNRLVLSATE	FADKLVEVGL	VGVLTLDNQD	LNGKWDYDFGD
MHV	WYDFVENSDI	INVYKKGPI	FNRLVLSATE	FADKLVEVGL	VGVLTLDNQD	LYGQWYDFGD
AIPV	WYDFVENSDI	YVMLAKMGPI	VRRALLNAIE	FGLNLMVEKGY	VGVLTLDNQD	LNGKWDYDFGD
SARS CoV	WYDFVENPDI	LRVYANLGER	VRQSLKTVQ	FCDAVMDAGI	VGVLTLDNQD	LNGKWDYDFGD
	245	255	265	275	285	295
EMCR	FVLSLPMNGV	PCCTSYYSYM	MPIMGLTNCL	ASECFVKSXI	FGSDFKTFDL	LKYDFTEHKE
229E	FVLCPPMGVI	PYCTSYYSYM	MPVMGMTNCL	ASECFVKSXI	FGQDFKTFDL	LKYDFTEHKE
PEDV	FTCSIKMGV	PICTSYYSYM	MPVMGMTNCL	ASECFVKSXI	FGEDFKSYDL	LEYDFTEHKT
TGEV	FVKTAPEGFC	ACVTSYYSYM	MPLMGMTSCL	ESENFVKSXI	YGSDFKQYDL	LAYDFTEHKE
BoCoV	YVIAAPGCGV	AIADSYYSYM	MPMLTMCHAL	DCELYVNNAV	R-----LFDL	VQYDFTDYKL
OC43	YVIAAPGCGV	AIADSYYSYM	MPMLTMCHAL	DCELYVNNAV	R-----LFDL	VQYDFTDYKL
MHV	FVKTVPGCGV	AVADSYYSYM	MPMLTMCHAL	DSELEFINGTY	R-----EFDL	VQYDFTDYKL
AIPV	FQKTAPEGAGV	PVFDYYSYM	MPILMTDAL	APERFYEDYV	HKG-YKSYDL	LKYDYTEERQ
SARS CoV	FQVAPGCGV	PIVDSYYSLL	MPILTLTRAL	AAESHMDADL	AKP-LIKWDL	LKYDYTEERL
	305	315	325	335	345	355
EMCR	NLFNKYFKHW	SFDYHPNCSD	CYDDMCVHC	ANFNLTFLATT	IPGTAFGPLC	RKVFDIGVPL
229E	VLFNKYFKYW	GQDYHPDCVD	CHDEMCIHLC	SNFNLTFLATT	IPNTAFGPLC	RKVFDIGVPL
PEDV	ALFNKYFKYW	GLQYHPNCVD	CSDEQCIHVC	ANFNLTFLSTT	IPITAFGPLC	RKCWIDGVPL
TGEV	YLFQYFKYW	DRYHPNCSD	CTSDECIHLC	ANFNLTFLSMT	IPMTAFGPLV	RKVHIDGVPL
BoCoV	ELFNKYFKHW	SMFYHPNTVD	CQDDRCIIHC	ANFNILFSMV	LPNTCFGPLV	RQIFVDGVPP
OC43	ELFNKYFKHW	SMFYHPNTVD	CQDDRCIIHC	ANFNILFSMV	LPNTCFGPLV	RQIFVDGVPP
MHV	ELFNKYFKYW	SMFYHPNTCE	CEDDRCIIHC	ANFNILFSMV	LPKTCFGPLV	RQIFVDGVPP
AIPV	ELFQYFKYW	DQYHPNCRD	CSDDRCIIHC	ANFNILFSTL	IPQTSFGNLC	RKVFDGVPP
SARS CoV	CLFDRYFKYW	DQYHPNCIN	CLDDRCIIHC	ANFNVLFTSTV	FPPTSFGPLV	RKIFVDGVPP

	365	375	385	395	405	415
EMCR	VTTAGYHFKQ	LGLVWNKDVN	THSVRLTITE	LLQFVTDPSL	IIASSPALVD	QRTICFSVAA
229E	VATAGYHFKQ	LGLVWNKDVN	THSTRLTITE	LLQFVTDPTL	IVASSPALVD	KRTVCFSVAA
PEDV	VTTAGYHFKQ	LGIWVNNDLN	LHSSRLSINE	LLQFCSDPAL	LIASSPALVD	QRTVCFSVAA
TGEV	VTTAGYHFKQ	LGIWVNNLDVK	LDTMKLSMTD	LLRFVTDPTL	LVASSPALLO	QRTVCFSIAA
BoCoV	VVSIGYHYKE	LGIWVNMDDV	THRYRLSLKD	LLLYAADPAL	HVASASALYD	LRTCCFSVAA
OC43	VVSIGYHYKE	LGIWVNMDDV	THRYRLSLKD	LLLYAADPAL	HVASASALYD	LRTCCFSVAA
MHV	VVSIGYHYKE	LGVVNMDDV	THRYRLSLKD	LLLYAADPAL	HVASASALLD	LRTCCFSVAA
AIPV	IATCGYHSKE	LGVIMNQDNT	MSFSKMGLSQ	LMQFVGDPAL	LVGTSNNLVD	LRTSCFSVCA
SARS CoV	VVSTGYHFRE	LGVVHNQDVN	LHSSRLSFKE	LLVYAADPAM	HAASGNLLLD	KRTTCFSVAA

	425	435	445	455	465	475
EMCR	LSTGLTNQVV	KPGHNEEFY	NFLRLRGFFD	EGSELTLLKH	FFAQNGDAAV	KDFDFYRYNK
229E	LSTGLTSQTV	KPGHNEKEFY	DFLRSQGFFD	EGSELTLLKH	FFTQKGDAAI	KDFDYRYNR
PEDV	LGTGMTNQT	KPGHNEKEFY	DFLLEQGFSS	EGSELTLLKH	FFAQKVDAAV	KDFDYRYNR
TGEV	LSTGITYQTV	KPGHNEKDFY	DFITERGFFE	EGSELTLLKH	FFAQGGGAAM	TDFNYRYNR
BoCoV	ITSGVKFQTV	KPGNFNQDFY	DFILSKGLLK	EGSSVDLKH	FFTQDGNAAI	TDYNYRYNL
OC43	ITSGVKFQTV	KPGNFNQDFY	DFVLSKGLLK	EGSSVDLKH	FFTQDGNAAI	TDYNYRYNL
MHV	ITSGVKFQTV	KPGNFNQDFY	EFILSKGLLK	EGSSVDLKH	FFTQDGNAAI	TDYNYRYNL
AIPV	LTSGITHQTV	KPGHNEKDFY	DFAEKAGMFK	EGSSIPLKH	FYPQTGNAAI	NDYDYRYNR
SARS CoV	LTNNVAFQTV	KPGNFNKDFY	DFAVSKGFEK	EGSSVELKH	FFAQDGNAAI	SDYDYRYNL

	485	495	505	515	525	535
EMCR	PTILDICQAR	VTYKIVSRYF	DIYEGGCIKA	CEVVVTNLNK	SAGWPLNFKG	KASLYYESIS
229E	PTMLDICOAR	VAYQVAARYF	DCYEGGCITS	REVVVTNLNK	SAGWPLNFKG	KAGLYYESIS
PEDV	PTVLDICQAR	VYQIVQRYF	DIYEGGCITA	KEVVVTNLNK	SAGYPLNFKG	KAGLYYESLS
TGEV	VTVLDICQAR	FVKIVGKYF	ECYDGGCINA	REVVVTNYDK	SAGYPLNFKG	KARLYYESLS
BoCoV	PTMVDIKQLL	FVLEVVKYF	EIYDGGCIPA	AQVIVNNYDK	SAGYPFNKFG	KARLYYEALS
OC43	PTMVDIKQLL	FVLEVVKYF	EIYDGGCIPA	SQVIVNNYDK	SAGYPFNKFG	KARLYYEALS
MHV	PTMVDIKQLL	FVLEVVKYF	EIYDGGCIPA	TQVIVNNYDK	SAGYPFNKFG	KARLYYEALS
AIPV	PTMEDICQLL	FCLEVTSKYF	ECYEGGCIPA	SQVIVNNLDK	SAGYPFNKFG	KARLYYE-MS
SARS CoV	PTMCDIRQLL	FVVEVVDKYF	DCYDGGCINA	NQVIVNNLDK	SAGFPFNKMG	KARLYYDSMS

	545	555	565	575	585	595
EMCR	YEEQDALFAL	TKRNVLPMT	QLNLKYAISG	KERARTVGGV	SLLSTMTTRQ	YHQKHLKSIV
229E	YEEQDAIFSL	TKRNILPTMT	QLNLKYAISG	KERARTVGGV	SLLATMTTRQ	FHQKCLKSIV
PEDV	YEEQDELYAY	TKRNILPTMT	QLNLKYAISG	KERARTVGGV	SLLSTMTTRQ	YHQKHLKSIV
TGEV	YEEQDALFAL	TKRNVLPMT	QMNLYKAISG	KARARTVGGV	SLLSTMTTRQ	YHQKHLKSIA
BoCoV	FEEQDEIYAY	TKRNVLPMT	QMNLYKAISA	KNRARTVAGV	SILSTMTGRM	FHQKCLKSIA
OC43	FEEQDEIYAY	TKRNVLPMT	QMNLYKAISA	KNRARTVAGV	SILSTMTGRM	FHQKCLKSIA
MHV	FEEQDEIYAY	TKRNVLPMT	QMNLYKAISA	KNRARTVAGV	SILSTMTGRM	FHQKCLKSIA
AIPV	LEEQDQLFEI	TKKNVLPMT	QMNLYKAISA	KNRARTVAGV	SILSTMTNRQ	FHQKILKSIV
SARS CoV	YEDQDALFAY	TKRNVLPMT	QMNLYKAISA	KNRARTVAGV	SICSTMTNRQ	FHQKILKSIA

	605	615	625	635	645	655
EMCR	NTRNATVVIG	TKFYGGWNN	MLRTLIDGVE	NPMLMGWDYP	KCDRALPNMI	RMISAMVLGS
229E	ATRNATVVIG	TKFYGGWNN	MLKNLMADVO	DPKLMGWDP	KCDRALPNMI	RMISAMVLGS
PEDV	NTRGASVVIG	TKFYGGWNN	MLKNLIDGVE	NPCLMGWDYP	KCDRALPNMI	RMISAMVLGS
TGEV	ATRNATVVIG	STKFYGGWNN	MLKNLMRDVO	NGCLMGWDYP	KCDRALPNMI	RMASAMVLGS
BoCoV	ATRGVPVVIG	TKFYGGWDD	MLRRLIKDVO	NPVLMGWDP	KCDRALPNIL	RIVSSVLAR
OC43	ATRGVPVVIG	TKFYGGWDD	MLRRLIKDVO	NPVLMGWDP	KCDRALPNIL	RIVSSVLAR
MHV	ATRGVPVVIG	TKFYGGWDD	MLRRLIKDVO	SPVLMGWDP	KCDRALPNIL	RIISSLVLAR
AIPV	NTRNASVVIG	TKFYGGWNN	MLRNLIQGVE	DPILMGWDYP	KCDRALPNLL	RIASLVLAR
SARS CoV	ATRGATVVIG	TSKFYGGWNN	MLKTVYSDE	TPHLMGWDP	KCDRALPNML	RIASLVLAR

	665	675	685	695	705	715
EMCR	KHVNCCCTVD	RFYRLGNELA	QVLTEVVYSN	GGFYFKPGGT	TSGDASTAYA	NSVFNIFQAV
229E	KHVTCCCTASD	KFYRLSNELA	QVLTEVVYSN	GGFYFKPGGT	TSGDATTAYA	NSVFNIFQAV
PEDV	KHVTCCSSTD	RFYRLGNELA	QVLTEVVYSN	GGFYFKPGGT	TSGDATTAYA	NSVFNIFQAV
TGEV	KHVGCCCTHND	RFYRLSNELA	QVLTEVVHCT	GGFYFKPGGT	TSGDGTATAYA	NSAFNIFQAV
BoCoV	KHEACCSQSD	RFYRLANECA	QVLSEIVMCG	GCYYVKPGGT	SSGDATTAYA	NSVFNICQAV
OC43	KHETCCCSQSD	RFYRLANECA	QVLSEIVMCG	GCYYVKPGGT	SSGDATTAYA	NSVFNICQAV
MHV	KHOSCCSHTD	RFYRLANECA	QVLSEIVMCG	GCYYVKPGGT	SSGDATTAYA	NSVFNICQAV
AIPV	KHTNCCCSWE	RIYRLYNECA	QVLSETVLAT	GGIYVKPGGT	SSGDATTAYA	NSVFNIIQAT
SARS CoV	KHNTCCNLSH	RFYRLANECA	QVLSEIVMCG	GSLYVKPGGT	SSGDATTAYA	NSVFNICQAV

	725	735	745	755	765	775
EMCR	SSINRLLSV	PSDCNNVNV	RDLQRLLYDN	CYRLTSVEES	FIDDIYGYLR	KHFSMMILSD
229E	SSINCVLSV	NSSNCNNFNV	KKLQRLLYDN	CYRNSNVEDS	FVDDFYGYLQ	KHFSMMILSD
PEDV	SANVNKLLSV	DSNVCHNLEV	KQLQRLLYEC	CYRSTIVDDQ	FVVEYGYLR	KHFSMMILSD
TGEV	SANVNKLLGV	DSNACNNVT	KSIQRLLYDN	CYRSSSIDEE	FVVEYFSYLR	KHFSMMILSD
BoCoV	SANVCALMSC	NGNKIEDLSI	RALQRLLYSH	VYRSDMVDS	FVTEYEFNL	KHFSMMILSD
OC43	SANVCALMSC	NGNKIEDLSI	RALQRLLYSH	VYRSDKVDST	FVTEYEFNL	KHFSMMILSD
MHV	SANVCALMAC	NGHKIEDLSI	RELQRLLYSN	VYRADHVDPA	FVNEYYEFLN	KHFSMMILSD
AIPV	SANVARLLSV	ITRDIVYDNI	KSLQYELYQQ	VYRRVNDPDA	FVEKFYSYLC	KNFSLMILSD
SARS CoV	TANVNALLST	DGNKIADKYV	RNLQRLLYEC	LYRNRDWDHE	FVDEFYAYLR	KHFSMMILSD

	785 795 805 815 825 835
EMCR	DGVVCYNKDY AELGYIADIS AFKATLYYQN NVFMSTSKCW VEEDLTGKPH EFCSQHTMQI
229E	DSVVCYNKTY AGLGYIADIS AFKATLYYQN GVFMSTAKCW TEEDLSIGPH EFCSQHTMQI
PEDV	DGVVCYNNDY ASLGYVADLN AFKAVLYYQN NVFMSASKCW IEPDINKGPH EFCSQHTMQI
TGEV	DGVVCYNKDY ADLGYVADIN AFKATLYYQN NVFMSTSKCW VEPDLSVGPH EFCSQHTLQI
BoCoV	DGVVCYNNDY ASKGYIANIS AFQOVLYYQN NVFMSESKCW VENDINNGPH EFCSQHTMLV
OC43	DGVVCYNNDY ASKGYIANIS AFQOVLYYQN NVFMSESKCW VEHDINNGPH EFCSQHTMLV
MHV	DGVVCYNSEF ASKGYIANIS AFQOVLYYQN NVFMSEAKCW VETDIEKGPH EFCSQHTMLV
AIPV	DGVVCYNNTL AKQGLVADIS GFREVLYYQN NVFMADSKCW VEPDLERKPH EFCSQHTMLV
SARS CoV	DAVVCYNSTY AAQGLVASIK NFKAVLYYQN NVFMSEAKCW TETDLTKGPH EFCSQHTMLV

	845 855 865 875 885 895
EMCR	VDKDGTYYLP YPDPSRILSA GVFVDDVVKT DAVVLLXRYV SLAIDAYPLS KHPNSEYRKV
229E	VDENGKYYLP YPDPSRIISA GVFVDDITKT DAVILLERYV SLAIDAYPLS KHPKPEYRKV
PEDV	VDKEGTYYLP YPDPSRILSA GVFVDDVVKT DAVVLLERYV SLAIDAYPLS KHENPEYKRV
TGEV	VGPDGYLYLP YPDPSRILSA GVFVDDIVKT DNVIMLERYV SLAIDAYPLT KHPKPAYQKV
BoCoV	KMDGDDVYLP YPVPSRILGA GCFVDDLLKT DSVLLIERFV SLAIDAYPLV YHENEYQKV
OC43	KMDGDDVYLP YPNPSRILGA GCFVDDLLKT DSVLLIERFV SLAIDAYPLV YHENEYQKV
MHV	KMDGDEVYLP YPDPSRILGA GCFVDDLLKT DSVLLIERFV SLAIDAYPLV YHENPEYQNV
AIPV	EVDGEPKYL P YPDPSRILGA CVFVDDVDKT EPVAVMERYI ALAIDAYPLV HHENEYKRV
SARS CoV	KQGGDYVYLP YPDPSRILGA GCFVDDIVKT DGTLMIERFV SLAIDAYPLT KHPNQEYADV

	905 915 925 935 945 955
EMCR	FYVLLDWVKH LNKNLNEGVL ESFSVTLLDN QEDKFWCEDF YASMYENSTI LQAAGLCVVC
229E	FYALLDWVKH LNKTLNEGVL ESFSVTLLDE HESKFWDESF YASMYEKSTV LQAAGLCVVC
PEDV	FYVLLDWVKH LYKTLNAGVL ESFSVTLLDE STAKFWDESF YANMYEKSAV LQAGLCVVC
TGEV	FYTLLDWVKH LQKLNAGVL DSFSVTMLLE QDKFWSEEF YASLYEKSTV LQAAGMCVVC
BoCoV	FRVYLEYIKK LYNELGNQIL DSYSVILSTC DGQKFTDESF YKNMYLRSV MQSVGACVVC
OC43	FRVLYLAYIKK LYNDLGNQIL DSYSVILSTC DGQKFTDESF YKNMYLRSV MQSVGACVVC
MHV	FRVYLEYIKK LYNDLGNQIL DSYSVILSTC DGQKFTDETF YKNMYLRSV MQSVGACVVC
AIPV	FFVLLAYIRK LYQELSQNML MDYSFVMDID KGSKEWEQEF YENMYRAPTT LQSCGCVVC
SARS CoV	FHLYLQYIRK LHDELTHGML DMYSVMLTND NTSRYWEPEF YEAMYPHTV LQAVGACVLC

	965 975 985 995 1005 1015
EMCR	GSQTVLRCDG CLRKFMCLCTK CAYDHVFGTD HKEFLAITPY VCNASGCGVS DVKKLYLGGL
229E	GSQTVLRCDG CLRRFMLCTK CAYDHVFGTD HKEFLAITPY VCNATSGCNV DVTKLYLGGL
PEDV	GSQTVLRCDG CLRRFMLCTK CAYDHVIGTT HKEFLAITPY VCCASDCGNV DVTKLYLGGL
TGEV	GSQTVLRCDG CLRRPLLCTK CAYDHVMGTH HKEFIMSITPY VCSFNGCNV DVTKFLPLGL
BoCoV	SSQTSRLCGS CIRKPLLCCK CCYDHVMATD HKYVLSVSPY VCNAPGCDVN DVTKLYLGGM
OC43	SSQTSRLCGS CIRKPLLCCK CCYDHVMATD HKYVLSVSPY VCNAPGCDVN DVTKLYLGGM
MHV	SSQTSRLCGS CIRKPLLCCK CAYDHVMSTD HKYVLSVSPY VCNAPGCDVN DVTKLYLGGM
AIPV	NSQTLRLCGN CIRKPLLCCK CCYDHVMHTD HKNVLSINPY ICSQLGCGEA DVTKLYLGGM
SARS CoV	NSQTSRLCGA CIRKPLLCCK CCYDHVISTS HKLVLSVNPY VCNAPGCDVT DVTKLYLGGM

	1025 1035 1045 1055 1065 1075
EMCR	NYCYCTNHKPP LSFPPLCSAGN IFGLYKNSAT GSLOVEVFNR LATSDWTDVR DYKLANDVKD
229E	NYCYVDHKKP LSFPPLCSAGN VFGLYKNSAL GSMOVIDFNR LSTSDWSDIR DYKLANDAKE
PEDV	SYWCHCHKPR LAFPLCSAGN VFGLYKNSAT GSPDVEDFNR IATSDWTDVS DYRLANDVKD
TGEV	SYCYCMNHKPP LSFPPLCANGN VFGLYKNSAV GSEAVEDFNK LAVSDWNTVE DYKLANNVKE
BoCoV	SYCYCDHKKP YSFKLVMNGH VFGLYKQSCT GSPYIDDFNR IASCKWTDVD DYILANECTE
OC43	SYCYCDHKKP YSFKLVMNGL VFGLYKQSCT GSPYIDDFNR IASCKWTDVD DYILANECTE
MHV	SYCYCDHKKP YSFKLVMNGH VFGLYKQSCT GSPYIEDFNK IASCKWTEVD DYVLANECTE
AIPV	SYFCGNHKKP LSIPLVSNGT VFGLYRANCA GSENVDDFNQ LATTNWSIVE PYILANRCSO
SARS CoV	SYCYCKSHKPP ISFPPLCANGQ VFGLYKNTCV GSDNVTDFNA IATCDWTNAG DYILANTCTE

	1085 1095 1105 1115 1125 1135
EMCR	TLRLFAAETI KAKEESVKSS YAFATLKEVV GPKELLLSWE SGKVKPPPLNR NSVFTCFQIS
229E	SLRLFAAETV KAKEESVKSS YAYATLKEIV GPKELLLLWE SGKAKPPPLNR NSVFTCFQIT
PEDV	SLRLFAAETI KAKEESVKSS YACATLHEVV GPKELLKWE VGRPKPPPLNR NSVFTCYHIT
TGEV	SLKIFAAETV KAKEESVKSE YAYAVLKEVI GPKELVLQWE ASKTKPPPLNR NSVFTCFQIS
BoCoV	RLKLFAAETQ KATEEAFKQS YASATIQEIV SERELILSWE IGKVKPPPLNK NYVFTGYHFT
OC43	RLKLFAAETQ KATEEAFKQS YASATIQEIV SERELILSWE IGKVKPPPLNK NYVFTGYHFT
MHV	RLKLFAAETQ KATEESFKQC YASATIREIV SDRELILSWE IGKVRPPPLNK NYVFTGYHFT
AIPV	SLRFAAETV KATEELHKQQ FASAEVREVF SDRELILSWE FGKTRPPPLNR NYVFTGYHFT
SARS CoV	RLKLFAAETL KATEETFKLS YGIATVREVL SDRELHLSWE VGKPRPPPLNR NYVFTGYRVT

	1145 1155 1165 1175 1185 1195
EMCR	KDSKFQIGEF IFEKVEYGS D TVTYKSTVTT KLVPGMIFVL TSHNVQPLRA PTIANQEKYS
229E	KDSKFQVGEF VFEKVDYGS D TVTYKSTATT KLVPGMLFIL TSHNVAPLRA PTMANQEKYS
PEDV	KNTKFQIGEF VFEKAEDND AVTYKTATT KLVPGMVFL TSHNVQPLRA PTIANQERYS
TGEV	KDTHQIGLGEF VFEQSEYGS D SVYYKSTSTY KLTPGMIFVL TSHNVSPFLA PILVNQEKYN
BoCoV	KNGKTVLGEY VFDKSEL-TN GVVYRATTTY KLSVGDVFLV TSHSVANLSA PTLVPQENYS
OC43	KNGKTVLGEY VFDKSEL-TN GVVYRATTTY KLSVGDVFLV TSHSVANLSA PTLVPQENYS
MHV	SNGKTVLGEY VFDKSEL-TN GVVYRATTTY KLSVGDVFLV TSHAVSSLSA PTLVPQENYS
AIPV	RTSKVQLGDF TFEKGEG-KD VVYYKATSTA KLSVGDIFVL TSHNVVSLVA PTLCPQOTFS
SARS CoV	KNSKVQIGEF TFEKGDY-GD AVVYRGTTY KLVNGDYFVL TSHTVMLSA PTLVPQEHYV

55/87

	1205 1215 1225 1235 1245 1255
EMCR	SIYKLHPAFN VSDAYANLVP YYQLIGKQRI TTIOGPPGSG KSHCSIGLGL YYPGARIVFV
229E	TIYKLHPSFN VSDAYANLVP YYQLIGKQRI TTIOGPPGSG KSHCSIGLGL YYPGARIVFT
PEDV	TIHKLHPAFN IPEAYSSLVP YYQLIGKQRI TTIOGPPGSG KSHCVIGLGL YYPGARIVFT
TGEV	TISKLYPVFN IAEAYNTLVP YYQMIGKQRF TTIOGPPGSG KSHCVIGLGL YYPQARIVYT
BoCoV	SIR-FASVYS VLETFQNNVV NYQHIGMKRY CTVOGPPGTG KSHLAIGLAV YYCTARVVYT
OC43	SIR-FASVYS VLETFQNNVV NYQHIGMKRY CTVOGPPGTG KSHLAIGLAV FYCTARVVYT
MHV	SIR-FASVYS VPETFQNNVP NYQHIGMKRY CTVOGPPGTG KSHLAIGLAV YYCTARVVYT
AIPV	RFVNLRPNVN VPECFVNNIP LYHLVGKQKR TTVOGPPGSG KSHFAIGLAV YFSSARVVYT
SARS CoV	RITGLYPTLN ISDEFSSNVA NYQKVGMOQY STLQGPPTG KSHFAIGLAV YFPSARIVYT

	1265 1275 1285 1295 1305 1315
EMCR	ACAHAAVDSL CAKAMTVYSI DKCTRIIPAR ARVECYSGFK PNNTSAQYIF STVNALPECN
229E	ACSHAAVDSL CAKAVTAYSV DKCTRIIPAR ARVECYSGFK PNNTSAQYIF STVNALPEVN
PEDV	ACSHAAVDSL CVKASTAYSN DKCSRIIPQR ARVECYDGFK SNNTSAQYLF STVNALPECN
TGEV	ACSHAAVDSL CEKAAKNFNV DRCSRIIPQR IRVDCYTGFK PNNTNAQYLF CTVNALPEAS
BoCoV	AASHAAVDAL CEKAYKFLNI NDCTRIIPAK VRVECYDKFK INDTRKYVF TTINALPEMV
OC43	AASHAAVDAL CEKAYKFLNI NDCTRIIPAK VRVECYDKFK INDTRKYVF TTINALPEMV
MHV	AASHAAVDAL CEKAYKFLNI NDCTRIIPAK VRVDCYDKFK VNDTRKYVF TTINALPELV
AIPV	ACSHAAVDAL CEKAFKFLKV DDCTRIIPQR TTVDCFSKFK ANDTGKKYIF STINALPEVS
SARS CoV	ACSHAAVDAL CEKALKYLPPI DKCSRIIPAR ARVECFDKFK VNSTLEQYVF CTVNALPETT

	1325 1335 1345 1355 1365 1375
EMCR	ADIVVVDEVS MCTNYDLSVI NQRLSYKHIV YVGDPQQLPA PRVMITKGMV EPVDYNVVTQ
229E	ADIVVVDEVS MCTNYDLSVI NQRLSYKHIV YVGDPQQLPA PRVLISKGMV EPIDYNVVTQ
PEDV	ADIVVVDEVS MCTNYDLSVI NQRLSYRHVV YVGDPQQLPA PRVMSRGTLP EPKDYNVVTQ
TGEV	CDIVVVDEVS MCTNYDLSVI NSRLSYKHIV YVGDPQQLPA PRTLINKGVL QPQDYNVVTK
BoCoV	TDIVVVDEVS MLTNYELSVI NARIRAKHYV YIGDPAQLPA PRVLLSKGTL EPKYFNTVTK
OC43	TDIVVVDEVS MLTNYELSVI NARIRAKHYV YIGDPAQLPA PRVLLSKGTL EPKYFNTVTK
MHV	TDIVVVDEVS MLTNYELSVI NSRVRAKHIV YIGDPAQLPA PRVLLNKGTL EPRYFNSVTK
AIPV	CDILLVDEVS MLTNYELSVI NGKINYQYVV YVGDPQQLPA PRTLLN-GSL SPKDYNVVTN
SARS CoV	ADIVVFDEIS MATNYDLSVV NARLRKHYV YIGDPAQLPA PRTLLTKGTL EPEYFNSVCR

	1385 1395 1405 1415 1425 1435
EMCR	RMCAIGPDVF LHKCYRCPAE IVNTVSELVY ENKFVPVKPA SKQCCKIFFK G---NVQVDN
229E	RMCAIGPDVF LHKCYRCPAE IVNTVSELVY ENKFVPVKEA SKQCCKIFER G---SVQVDN
PEDV	RMCAIKPDVF LHKCYRCPAE IVRTVSEMVY ENQFIPVHPD SKQCCKIFCK G---NVQVDN
TGEV	RMCTLGPDVF LHKCYRCPAE IVKTVSALVY ENKFVPVNPPE SKQCCKFMFK G---QVQIES
BoCoV	LMCCLGPDIF LGTCYRCPKE IVDTVSALVY ENKLKAKNES SSLCFKVVYK G---VTTHES
OC43	LMCCLGPDIF LGTCYRCPKE IVDTVSALVY ENKLKAKNES SSLCFKVVYK G---VTTHES
MHV	LMCCLGPDIF LGTCYRCPKE IVDTVSALVY ENKLKAKNDN SSMCFKVVYK G---QTTTHES
AIPV	LMVCVKPDIF LAKCYRCPKE IVDTVSTLVY DQKFIANNFE SRECCKFVIVN NGNSDVGHEH
SARS CoV	LMKTIGPDMF LGTCRRCPAE IVDTVSALVY DNKLKAHKDK SAQCCKMFYK G---VITHDV

	1445 1455 1465 1475 1485 1495
EMCR	GSSINRRQLE IVKLFVLKNP SWSKAVFISP YNSQNYVASR FLGLQIQTV D SSQGSEYDYV
229E	GSSINRRQLD VVKRFIHKNS TWSKAVFISP YNSQNYVAAR LLGLQQTVD SAQGSEYDYV
PEDV	GSSINRRQLD VVRMFIAKNP RWSKAVFISP YNSQNYVASR LLGLQIQTV D SSQGSEYDYV
TGEV	NSSINRRQLE VVKAFLAHP KWRKAVFISP YNSQNYVARR LLGLQQTVD SAQGSEYDYV
BoCoV	SSAVNMQQIY LINKFLKANP LWHKAVFISP YNSQNFPAKR VLGLQQTVD SAQGSEYDYV
OC43	SSAVNMQQIY LINKFLKANP LWHKAVFISP YNSQNFPAKR VLGLQQTVD SAQGSEYDYV
MHV	SSAVNMQQIY LISKFLKANP SWSNAVFISP YNSQNYVAKR VLGLQQTVD SAQGSEYDYV
AIPV	GSAYNTTQLE FVKDFVCRNK QWREAFISP YNAMNQRAYR MLGLNVQTV D SSQGSEYDYV
SARS CoV	SSAINRRPQIG VVREFLTRNP AWRKAVFISP YNSQNAVASK ILGLPTQTV D SSQGSEYDYV

	1505 1515 1525 1535 1545 1555
EMCR	IYAQTSDTAH ACNVNRFNVA ITRAKKGIFC VMCDKT-LFD SLKFFEIKHA --DLHSS---
229E	IYAQTSDTAH ACNANRFNVA ITRAKKGIFC IMSDRT-LFD ALKFFEITMT --DLQSE---
PEDV	IYAQTSDTAH ASNVNRFNVA ITRAKKGILC IMCDRS-LFD LLKFFELKLS --DLQAN---
TGEV	IYTQTSDTQH ATNVNRFNVA ITRAKVGILC IMCDRT-MYE NLDIFYELKDS KIGLQAKP---
BoCoV	IYSQTAETAH SVNVNRFNVA ITRAKKGILC VMSNMQ-LFE ALQFTTLTVD KVPQAVETRV
OC43	IYSQTAETAH SVNVNRFNVA ITRAKKGILC VMSNMQ-LFE ALQFTTLTLD KVPQAVETRV
MHV	IYSQTAETAH SVNVNRFNVA ITRAKKGILC VMSSMQ-LFE SLNFTSLTLD KIN---NPLR
AIPV	IFCVTADSQH ALNINRFNVA ITRAKRGILV VMQRDELYS ALKFTELDSE TSLQG-----
SARS CoV	IFTQTETETAH SCNVNRFNVA ITRAKIGILC IMSDRD-LYD KLQFTSLLEIP RRN-VATLQA

	1565 1575 1585 1595 1605 1615
EMCR	-QVCGLFKNC TRTPLNLPPT HAHTFLSLSD QFKTTGDLAV QIGSNN--VC TYEHVISFMG
229E	-SSCGLFKDC ARNPIDLPPS HATTYLSLSD RFKTSGLAV QIGNNN--VC TYEHVISFMG
PEDV	-EGCGLFKDC SRGDDLLPPS HANTFMSLAD NFKTDQYLAV QIGVNG--PI KYEHVISFMG
TGEV	-ETCGLFKDC SKSEQYIPPA YATTYMSLSD NFKTSGLAV NIG-TK--DV KYANVISFMG
BoCoV	QCSTNLFKDC SKSYSGYHPA HAPSFLAVDD KYKATGDLAV CLGIGD-SAV TYSRLISLMG
OC43	QCSTNLFKDC SKSYSGYHPA HAPSFLAVDD KYKATGDLAV CLGIGD-SAV TYSRLISLMG
MHV	QCTTNLFKDC SRSYAGYHPA HAPSFLAVDD KYKVGGLAV CLNVAD-SAV TYSRLISLMG
AIPV	---TGLFKIC NKEFSGVHPA YAVTTKALAA TYKVNDELA LNVNVEAGSEI TYKHLISLLG
SARS CoV	ENVTLGFKDC SKIITGLHPT QAPTHLSVDI KFKTEG-LCV DIPGIP-KDM TYRRLISMMG

SUBSTITUTE SHEET (RULE 26)

	1625	1635	1645	1655	1665	1675
EMCR	FRFDISIPGS	HSLFCTRDFA	IRNVRGWLGM	DVESAHVCGD	NIGTNVPLQV	GFSNGVNFVV
229E	FRFDVSMPGS	HSLFCTRDFA	MRHVRGWLGM	DVEGAHVTDG	NVGTNVPLQV	GFSNGVDVFA
PEDV	FRFDINIPNH	HTLFCTRDFA	MRNVRGWLGF	DVEGAHVVG	NVGTNVPLQL	GFSNGVDVFFV
TGEV	FRFEANIPGY	HTLFCTRDFA	MRNVRAWLGF	DVEGAHVCGD	NVGTNVPLQL	GFSNGVDVFFV
BoCoV	FKLDVTLDDGY	CKLFITKEEA	VKRVRWVGF	DAEGAHAATRD	SIGTNFPLQL	GFSTGIDFVV
OC43	FKLDVTLDDGY	CKLFITKEEA	VKRVRWVGF	DAEGAHAATRD	SIGTNFPLQL	GFSTGIDFVV
MHV	FKLDLTLDDGY	CKLFITRDEA	IRRVRAWVGF	DAEGAHAATRD	SIGTNFPLQL	GFSTGIDFVV
AIPV	FKMSVNVGEC	HNMFITRDEA	IRNVRGWVGF	DVEATHACGT	NIGTNLPFQV	GFSTGADFVV
SARS CoV	FKMNYQVNGY	PNMFITREEA	IRHVRWVGF	DVEGCHATRD	AVGTNLPQL	GFSTGVNLVA

	1685	1695	1705	1715	1725	1735
EMCR	QTEGCVSTNF	GDVIKPVCAK	SPGGEQFRHL	VPFLRKQGPW	LIVRRRIVQM	ISDYLNLSD
229E	QPEGCVLTNT	GSVVKPVRAR	APPGGEQFTHI	VPFLRKQGPW	SVLRKRIVQM	IADFLAGSSD
PEDV	RPEGCVVTES	GDYIKPVRAR	APPGGEQFAHL	LPFLRKQGPW	DVVRKRIVQM	CSDYLANLSD
TGEV	QTEGCVITEK	GNSIEVVKAR	APPGGEQFAHL	IPLMRKQGPW	HIVRRRIVQM	VCDYDFGLSD
BoCoV	EATGLFADRD	GYSFKKAVAK	APPGGEQFKHL	IPLMTRGQRW	DVVRPRIVQM	FADHLIDLSD
OC43	EATGLFADRD	GYSFKKAVAK	APPGGEQFKHL	IPLMTRGHRW	DVVRPRIVQM	FADHLIDLSD
MHV	EATGMFAERD	GYVFKKAVAR	APPGGEQFKHL	VPLMSRGQKW	DVVRIRIVQM	LSOHLVDLAD
AIPV	TPEGLVDTSI	GNNFEPVNSK	APPGGEQFNHL	RVLFKSAKPW	HVIRPRIVQM	LADNLCNVSD
SARS CoV	VPTGVVDTEN	NTEFTRVNAK	PPPGDQFKHL	IPLMYKGLPW	NVVRIRIVQM	LSDTLKGSLD

	1745	1755	1765	1775	1785	1795
EMCR	ILVFLWAGS	LELTMMRYEV	KIGPIKYCY-	CGNSATCYNS	VSNEYCCFKH	ALGCDYVYNP
229E	VLVFLWAGG	LELTMMRYEV	KIGAVKHCO-	CGTVATCYNS	VSNDYCCFKH	ALGCDYVYNP
PEDV	ILIFVLWAGG	LELTMMRYEV	KIGPSKSCD-	CGKVATCYNS	ALHTYCCFKH	ALGCDYLYNP
TGEV	ILIFVLWAGG	LELTMMRYEV	KIGRPQKCE-	CGKSATCYSS	SQSVYACFKH	ALGCDYLYNP
BoCoV	CVVLVTWAAN	FELTCLRYFA	KVGREISCNV	STKRATAYNS	RTGYGCGWRH	SVTCDYLYNP
OC43	CVVLVTWAAN	FELTCLRYFA	KVGREISCNV	CTKRATVYNS	RTGYGCGWRH	SVTCDYLYNP
MHV	SVVLVTWAAS	FELTCLRYFA	KVGKEVVCV	CNKRATCFNS	RTGYGCGWRH	SYSCDYLYNP
AIPV	CVVFTWCHG	LELTTLRYEV	KIGKEQVCS-	CGSRATTFNS	HTQAYACWKH	CLGDFDYVYNP
SARS CoV	RVVFLWAHG	FELTSMKYEV	KIGPERTCCL	CDKRATCFST	SSDTYACWNH	SVGFDYVYNP

	1805	1815	1825	1835	1845	1855
EMCR	YAFDIQQWGY	VGSLSNHHT	FCNIHRNEHD	ASGDAVMTRC	LAVHDCFKVN	VDWTVTYPEI
229E	YVIDIQQWGY	VGSLSTNHHA	ICNVHRNEHV	ASGDAIMTRC	LAVYDCFKVN	VDWSITYPMI
PEDV	YCIDIQQWGY	KGSLSLNHHE	HCNVHRNEHV	ASGDAIMTRC	LAIHDCFKVN	VDWSITYPMI
TGEV	YCIDIQQWGY	TGSLSMNHHE	VCNIHRNEHV	ASGDAIMTRC	LAIHDCFKVR	VDWSIVYPMI
BoCoV	LIVDIQQWGY	IGSLSSNHDL	YCSVHKGAVH	ASSDAIMTRC	LAVYDCFCNN	INWNVYPII
OC43	LIVDIQQWGY	IGSLSSNHDL	YCSVHKGAVH	ASSDAIMTRC	LAVYDCFCNN	INWNVYPII
MHV	LIVDIQQWGY	TGSLTNSHDL	ICSVHKGAVH	ASSDAIMTRC	LAVHDCFKCS	VNWSLEYPII
AIPV	LIVDIQQWGY	SGNLQFNHDL	HCNVHGHAVH	ASVDAIMTRC	LAINNAFCQD	VNWDLYPHI
SARS CoV	FMIDVQQWGF	TGNLQSNHDO	HCQVHGNAHV	ASCDAIMTRC	LAVHECFVKR	VDWSVEYPII

	1865	1875	1885	1895	1905	1915
EMCR	ANEKFIINGCG	RNVQGHVVRA	ALKLYKPSVI	HDIGNPKGVR	CA-VTDAKWY	CYDKQPVNSN
229E	ANENAINKGG	RTVQSHIMRA	AIKLYNPKAI	HDIGNPKGIR	CA-VTDAKWY	CYDKNPINSN
PEDV	GNEAVINKSG	RIVQSHIMRS	VLKLYNPKAI	YDIGNPKGIR	CA-VTDAKWY	CFDKNPINSN
TGEV	DNEEKINKAG	RIVQSHIMKA	ALKIFNPAAI	HDVGNPKGIR	CA-TTPIPF	CYDRDPINNN
BoCoV	SNELISINTSC	RVLQRMVILKA	AMLCNRYTLC	YDIGNPKAIA	CV--KDFDFK	FYDAQPIVKS
OC43	SNELISINTSC	RVLQRMVILKA	AMLCNRYTLC	YDIGNPKAIA	CV--KDFDFK	FYDAQPIVKS
MHV	SNEVSVNTSC	RLQRMVIFRA	AMLCNRYDVC	YDIGNPKGLA	CV--KGYDFK	FYDASPVVKS
AIPV	ANEDEVNSSC	RYLQRMVILNA	CVDALKVNVV	YDIGNPKGIK	CVRRGDVNF	FYDKNPVIRN
SARS CoV	GDELRVNSAC	RKVQHMVVK	ALLADKFPVL	HDIGNPKAIK	CVPOAEVEWK	FYDAQPCSDK

	1925	1935	1945	1955	1965	1975
EMCR	---VKLLDYO	YATHG--QLD	GLCLFWNCNV	DMYPEFSIVC	RFDTRTRSVF	NLEGVNGGSL
229E	---VKTLEYD	YATHG--QMD	GLCLFWNCNV	DMYPEFSIVC	RFDTRTRSTL	NLEGVNGGSL
PEDV	---VKTLEYD	YITHG--QFD	GLCLFWNCNV	DMYPEFSVVC	RFDTRCRSPL	NLEGVNGGSL
TGEV	---VRCLOYD	YMVHG--QMN	GLMLFWNCNV	DMYPEFSIVC	RFDTRTRSKL	SLEGVNGGSL
BoCoV	---VKTLLYF	FEAHKDSFKD	GLCMFWNCNV	DKYPANAVVC	RFDTRVLNNL	NLPGCNGGSL
OC43	---VKTLLYF	FEAHKDSFKD	GLCMFWNCNV	DKYPANAVVC	RFDTRVLNNL	NLPGCNGGSL
MHV	---VKQFVYK	YEAHKDQFLD	GLCMFWNCNV	DKYPANAVVC	RFDTRVLNNL	NLPGCNGGSL
AIPV	---VKQFEYD	YNQHKDKFAD	GLCMFWNCNV	DCYPDNLSVC	RYDTRNLVSF	NLPGCNGGSL
SARS CoV	AYKIEELFYS	YATHHDKFTD	GVCLFWNCNV	DRYANAIVC	RFDTRVLNSL	NLPGCNGGSL

	1985	1995	2005	2015	2025	2035
EMCR	YVNNHAFHTP	AYDKRAFAVL	KPMPPFFYDD	SDCDVVC---	-EQVNYVPLR	ASSCVTRCNI
229E	YVNNHAFHTP	AYDKRAMAKL	KPAPEFFYDD	GSCEVH---	-DQVNYVPLR	ATNCITKCN
PEDV	YVNNHAFHTP	AFDKRAFAKL	KPMPPFFYDD	TECDKLQ---	-DSINYVPLR	ASNCITKCN
TGEV	YVNNHAFHTP	AYDRRAFAKL	KPMPPFFYDD	SNCELVD---	-GQPNYVPLR	SNVCITKCN
BoCoV	YVNNHAFHTK	PFSRAAFEHL	KPMPPFFYSD	TPCVYMDGMD	AKQVDYVPLK	SATCITRCNL
OC43	YVNNHAFHTK	PFARAAFEHL	KPMPPFFYSD	TPCVYMDGMD	AKQVDYVPLK	SATCITRCNL
MHV	YVNNHAFHTS	PFTRAAFENL	KPMPPFFYSD	TPCVYMEGME	SKQVDYVPLR	SATCITRCNL
AIPV	YVNNHAFYTP	KFDRISEFNL	KAMPFFFYSD	SPCETIQ-VD	GVAQDLVSLA	TKDCITKCN
SARS CoV	YVNNHAFHTP	AFDKSAFTNL	KQLPFFFYSD	SPCESHGKQV	VSDIDYVPLK	SATCITRCNL

	2045	2055	2065	2075	2085	2095
EMCR	GGAVCSKHAN	LYQKYVEAYN	TFTQAGFNIW	VPHSFDVYNL	WQIFIET-NL	QSLNIAFNV
229E	GGAVCSKHAN	LYRAYVESYN	IFTQAGFNIW	VPTTFDCYNL	WQTFTEV-NL	OGLNIAFNV
PEDV	GGAVCSKHCA	MYHSYVNAYN	TFTSAGFTIW	VPTSFDTYNL	WQTFSN--NL	OGLNIAFNV
TGEV	GGAVCKKHA	LYRAYVEDYN	IFMQAGFTIW	CPQNFDTYML	WHGFVNSKAL	QSLNIAFNV
BoCoV	GGAVCLKHAE	EYREYLESYN	TATTAGFTFW	VYKTFDFYNL	WNTFTK---L	QSLNVVYNL
OC43	GGAVCLKHAE	EYREYLESYN	TATTAGFTFW	VYKTFDFYNL	WNTFTK---L	QSLNVVYNL
MHV	GGAVCLKHAE	EYREYLESYN	TATTAGFTFW	VYKTFDFYNL	WNTFTK---L	QSLNVVYNL
AIPV	GGAVCKKHAQ	MYAEFVTSYN	AAVTAGFTFW	VTNKLNPYNL	WKSFS---L	QSIDNIAYNM
SARS CoV	GGAVCRHHAN	EYRQYLDAYN	MMISAGFSLW	IYKQFDTYNL	WNTFTK---L	QSLNVAYNV

	2105	2115	2125	2135	2145	2155
EMCR	VKKGCFGTVD	GELPVAVVND	KVFVRYGDVD	NLVFTNKTTL	PTNVAFELFA	KRKMGLTPPL
229E	VNKGSEFVGD	GELPVAISGD	KVFVRDGNTO	NLVFVNKTSL	PTNIAFELFA	KRKVGLTPPL
PEDV	LKKGSFVGD	GELPVAVVND	KVLVRDGTVD	TLVFTNKTSL	PTNVAFELFA	KRKVGLTPPI
TGEV	VKKGAFTGLK	GDLPTAVIAD	KIMVRDGTVD	KCIFTNKTSL	PTNVAFELFA	KRKLGLTPPL
BoCoV	VKTGHYTGQA	GEMPCAIIND	KVVAKIDKED	VVIFINNTTY	PTNVAFELFA	KRSIRHHPPL
OC43	VKTGHYTGQA	GEMPCAIIND	KVVAKIDKED	VVIFINNTTY	PTNVAFELFA	KRSVRHHPPL
MHV	VNAGHFDGRA	GELPCAVIGE	KVIAKIONED	VVVFKNNTPF	PTNVAFELFA	KRSIRHHPPL
AIPV	YKGGHYDAIA	GEMPTVITGD	KVFVIDQGV	KAVFVNQTTL	PTSVAFELFA	KRMIRLTPNN
SARS CoV	VNKGHFDGHA	GEAPVSIINN	AVYTKVDGID	VEIFENKTTL	PVNVAFELWA	KRMIRPVPEI

	2165	2175	2185	2195	2205	2215
EMCR	SILKNLGVVA	TYKFLWDYE	AERPFTSYTK	SVCKYTDNF-	-----EDV	CVCFDNSIQG
229E	SILKNLGVVA	TYKFLWDYE	AERPLTSFTK	SVCGYTDFA-	-----EDV	CTCYDNSIQG
PEDV	TILRLNLGVV	TSKCVWDYE	AERPLTFTTK	DVCKYTDNF-	-----GDV	CTLFDNSIVG
TGEV	TILRLNLGVVA	TYKFLWDYE	AERPFSNFTK	QVCSYTDLD-	-----SEV	VTCFDNSIAG
BoCoV	KLFRNLNIDV	CWKHVIWDYA	RESIFCSNTY	GVCMTYDLK-	-----LIDKL	NVLFDGRDNG
OC43	KLFRNLNIDV	CWKHVIWDYA	RESIFCSNTY	GVCMTYDLK-	-----FIDKL	NVLFDGRDNG
MHV	KLFRNLNIDV	CWKHVIWDYA	KDSVFCSSY	KVCKYTDLQ-	-----CIESL	NVLFDGRDNG
AIPV	RILKGLGVVD	TNGFVIWDYA	NQTPLYRNTV	KVCAYTDIE-	-----PNGL	VVLYDDR-YG
SARS CoV	KILNLGVDI	AANTVIWDYK	REAPAHVSTI	GVCTMTDIAK	KPTESACSSL	TVLFDGRVGE

	2225	2235	2245	2255	2265	2275
EMCR	SYERTTLTN	AVLFSTVVIK	N-----LTPIK	LNFGMLNGMP	VSSIKSDKGV	EKLWNWYTYV
229E	SYERTTLSTN	AVLFSAVAVK	TGGKSLPAIK	LNFGMLNGNA	IATVKSEEDGN	IKNINWVYV
PEDV	SLERFSMTQN	AVLMSLTAVK	K-----LTGK	LYGYLNGVP	VNTHED----	-KPFTWYIYT
TGEV	SFERFTTTTRD	AVLISNNAVK	G-----LSAIK	LOYGLLNDLP	VSTVGN----	-KPVWYIYV
BoCoV	ALEAFKRSNN	GVYISTTKVK	S-----LSMIR	GPRAELNGV	VVDKVGDD--	-TDCVFYFAV
OC43	ALEAFKRSNN	GVYISTTKVK	S-----LSMIR	GPRAELNGV	VVDKVGDD--	-TDCVFYFAV
MHV	ALEAFKKCRD	GVYINTTKIK	S-----LSMIK	GPORADLNGV	VVEKVGDD--	-SDVEFWFAM
AIPV	DYQSFLAADN	AVLVSTQCYK	R-----YSYVE	IPSNLLVQNG	MPLKDG----	-ANLYVYK
SARS CoV	QVDLFRNARN	GVLTGEGSVK	G-----LTPSK	GPAQASVNGV	TLIGES----	-VKTQFNFYK

	2285	2295	2305	2315	2325	2335
EMCR	RKNG-----	Y-----QFQDH	Y-----	Y-----	Y-----DGFTQ	GRNLSDFTPR
229E	RKDG-----	Y-----KPVVDH	Y-----	Y-----	Y-----DGFTQ	GRNLQDFLPR
PEDV	RKNG-----	Y-----KFEDY	Y-----	Y-----	Y-----DGFTQ	GRTTADFSPR
TGEV	RKNG-----	Y-----EYVEQ	Y-----	Y-----	Y-----DSYTTQ	GRTFETFKPR
BoCoV	RKEGQDVIFS	QFDSLVRSSN	QSPQGNLGSN	-EPGNVGGND	ALATSTIFTQ	SRVSSFTCR
OC43	RKEGQDVIFS	QFDSLVRSSN	QSPQGNLGSN	-EPGNVGGND	ALSISTIFTQ	SRVSSFTCR
MHV	RRDGDVIFS	RTGSLPSHY	RSPQGNPGGN	-RVGDLSGNE	ALARGTIFTQ	SRFLSSFPAP
AIPV	RVNG-----	Y-----AFVTL	Y-----	Y-----	Y-----NTINTQ	GRSYETFEPR
SARS CoV	YVKG-----	Y-----IIQQL	Y-----	Y-----	Y-----ETYFTQ	SRDLEDFKPR

	2345	2355	2365	2375	2385	2395
EMCR	SDMEYDFLNM	DMGVFINKYG	LEDNFNEHVV	YGDVSKTTLG	GLHLLISQFR	LSKMGVLKAD
229E	STMEEDFLNM	DIGVFIQKYG	LEDNFNEHVV	YGDVSKTTLG	GLHLLISQVR	LSKMGILKAE
PEDV	SDMEKDFLSM	DMGLFINKYG	LEDYGFHEVV	YGDVSKTTLG	GLHLLISQVR	LACMGVLKID
TGEV	STMEEDFLSM	DTTLFIQKYG	LEDYGFHEVV	FGDVSKTTIG	GMHLLISQVR	LAKMGLFSVQ
BoCoV	TDMEKDFIAL	DQDVFIQKYG	LEDYAFEHIV	YGNFNQKIIG	GLHLLIGLYR	RQQTSLNLVIQ
OC43	TDMEKDFIAL	DQDVFIQKYG	LEDYAFEHIV	YGNFNQKIIG	GLHLLIGLYR	RQQTSLNLVQV
MHV	SEMEKDFMDL	DEDVFIKAYS	LQDYAFEHVV	YGSFNQKIIG	GLHLLIGLAR	RQOKSLNLVIQ
AIPV	SDIERDFLAM	SEESFVERYG	-KDLGLQHIL	YGEVDKPOLG	GLHTVIGMYR	LLRANKLNAK
SARS CoV	SQMETDFLEL	AMDEFIQRK	LEGYAFEHIV	YGDVSHGQLG	GLHLMIGLAK	RSQDSPLKLE

	2405	2415	2425	2435	2445	2455
EMCR	DEFVTSADTTL	RCCTVTYLINE	LSSKVVCTYM	DLLDDFVTI	LK---SLDLG	VISKVHEVII
229E	EFVASADITL	KCCTVTYLINE	PSSKTVCTYM	DLLDDFVSV	LK---SLDLT	VVSKVHEVII
PEDV	EFVSSNDSTL	KSCTVTYADN	PSSKVMCTYM	DLLDDFVSI	LK---SLDLS	VVSKVHEVMV
TGEV	EFMNSDSTL	KSCCITYADD	PSSKNVCTYM	DLLDDFVTI	IK---SLDLN	VVSKVVDVIV
BoCoV	EFVS-YDSSI	HSYFITDEKS	GGSKSVCTVI	DLLDDFVAL	VR---SLNLN	CVSKVVNVNV
OC43	EFVS-YDSSI	HSYFITDEKS	GGSKSVCTVI	DLLDDFVAL	VR---SLNLN	CVSKVVNVNV
MHV	EFVP-YDSSI	HSYFITDENS	GGSKSVCTVI	DLLDDFVDI	VR---SLNLN	CVSKVVNVNV
AIPV	SVTN-SDSDV	MQNYFVLSDN	GSYKQVCTVV	DLLDDFLEL	LRNILEKEYGT	NKSKVVTVSI
SARS CoV	DFIP-MDSTV	KNYFITDAQT	GSSKCVCSVI	DLLDDFVEI	IK---SQDLS	VISKVVKVTI

	2465	2475	2485	2495	2505	2515
EMCR	DNKPYRWMLW	CKDNHLSFTY	PQLQS-AEWK	CGYAMPQIYK	LQRMCLPCPN	LYNYGAGIKL
229E	DNKPYRWMLW	CKDNVATFTY	PQLQS-AEWK	CGYSMPGIYK	TQRMCLPCPN	LYNYGAGIKL
PEDV	DCKMWRWMLW	CKDHKLQTFY	PQLQA-SEWK	CGYSMPSIYK	IQRMCLPCPN	LYNYGAGVKL
TGEV	DCKAWRWMLW	CENSHIKTFY	PQLQS-AEWN	PGYSMPTLYK	IQRMCLERCN	LYNYGAQVKL
BoCoV	DFKDFQFMLW	CNDEKVMFTY	PRLQAASDWK	PGYSMPVLYK	YLNSPMERVS	LWNYGKPVTL
OC43	DFKDFQFMLW	CNDEKVMFTY	PRLQAASDWK	PGYSMPVLYK	YLNSPMERVS	LWNYGKPVTL
MHV	DFKDFQFMLW	CNEEKVMTFY	PRLQAASDWK	PGYVMPVLYK	YLESPLERVN	LWNYGKPVTL
AIPV	DYHSINFTW	FEDGSIKTCY	PQLQS--AWT	CGYNMPELYK	VQNCVMEPCN	IPNYGVGITL
SARS CoV	DYAEISFMLW	CKDGHVETFY	PKLQASQAWQ	PGVAMPNLYK	MQRMLLERCD	LQNYGENAVI

	2525	2535	2545	2555	2565	2575
EMCR	PSGIMLNVVK	YTQLCQYLNS	TTCVPHNMR	VLHYGAGSDK	GVAPGTTVLK	RWLPPD----
229E	PSGIMFNVVK	YTQLCQYFNS	TTLCPVPHMR	VLHLGAGSDY	GVAPGTAVLK	RWLPHD----
PEDV	PDGIMFNVVK	YTQLCQYLNS	TTCVPHHMR	VLHLGAGSDK	GVAPGTAVLR	RWLPLD----
TGEV	PDGITTNVVK	YTQLCQYLNT	TTLCPVHKMR	VLHLGAAGAS	GVAPGSTVLR	RWLPPD----
BoCoV	PTGCMNNVAK	YTQLCQYLNT	TTLAVPVNTR	VLHLGAGSEK	GVAPGSAVLR	QWLPAGTILR
OC43	PTGCMNNVAK	YTQLCQYLNT	TTLAVPVNMR	VLHLGAGSEK	GVAPGSAVLR	QWLPAG----
MHV	PTGCMNNVAK	YTQLCQYLNT	TTLAVPANMR	VLHLGAGSDK	DVAPGSAVLR	QWLPAG----
AIPV	PSGIMLNVAK	YTQLCQYLSK	TTICVPHNMR	VMHFGAGSDK	GVAPGSTVLK	QWLPEG----
SARS CoV	PKGIMNNVAK	YTQLCQYLNT	LTLAVPVNMR	VIHFGAGSDK	GVAPGTAVLR	QWLPTG----

	2585	2595	2605	2615	2625	2635
EMCR	-----AIII	DNDINDYVSD	ADFSITGDCA	TVYLEDKFDL	LISDMYDG--	--RIKFCDGE
229E	-----AIVV	DNDVDYVSD	ADFSVTGDCA	TVYLEDKFDL	LISDMYDG--	--RTKAIDGE
PEDV	-----AIIV	DNDSDYVSD	ADYSVTGDCA	TLYLSDFKFDL	VISDMYDG--	--RIKSCDGE
TGEV	-----AILV	DNDLRDYVSD	ADFSVTGDCT	SLYIEDKFDL	LVSPLYDG--	--STKSIDGE
BoCoV	QWLPAGTILV	HNDLYPFVSD	SVATYFGDCI	TLPPDCQWDL	IISDMYD--	--LLLDIGVH
OC43	-----TILV	DNDLYPFVSD	SVATYFGDCI	TLPPDCQWDL	IISDMYD--	--ITKNIGEY
MHV	-----SILV	DNDINPFVSD	SVASYYGNCI	TLPIACQWDL	IISDMYD--	--LTKNIGEY
AIPV	-----TLV	DNDIDYVSD	AHVSVLSDCN	KYNTEHKKFDL	VISDMYTND	SKRKHEGVIA
SARS CoV	-----TLV	DSLDNDFVSD	ADSTLIGDCA	TVHTANKWDL	IISDMYD--	--RTKHVTKE

	2645	2655	2665	2675	2685	2695
EMCR	NVSKOGFFTY	LNGVIREKLA	IGGSVAIKIT	EYSWNKLYE	LIQRFAPWTL	FCTSVNTSSS
229E	NVSKOGFFTY	INGFICEKLA	IGGSIAIKVT	EYSWNKLYE	LVQRFSPWTM	FCTSVNTSSS
PEDV	NVSKOGFFTY	INGVITEKLA	LGGSVAIKVT	EFSWNKLYE	LIQKFEYWTM	FCTSVNTSSS
TGEV	NVSKOGFFTY	INGFIREKLS	LGGSVAIKIT	EFSWNKLYE	LIQRFEPWTV	FCTSVNTSSS
BoCoV	VVRCS---YI	HCHMIRDKLA	LGGSVAIKIT	EFSWNAELYK	LMGYFAFWTV	FCTNANASSS
OC43	NVSKOGFFTY	ICHMIRDKLA	LGGSVAIKIT	EFSWNAELYK	LMGYFAFWTV	FCTNANASSS
MHV	NVSKOGFFTY	LCHLIRDKLA	LGGSVAIKIT	EFSWNAELYS	LMGKFAFWTI	FCTNVNASSS
AIPV	NNGNDVFIY	LSSFLRNLA	LGGSFAVKVT	ETSWHEVLYD	IAQDCAWWTM	FCTAVNASSS
SARS CoV	NDSKEGFFTY	LGGFIQKLA	LGGSIAVKIT	EHSWNADLYK	LMGHFSWNTA	FVTNVNASSS

	2705	2715	2725	2735	2745	2755
EMCR	EAFLLIGINYL	GDFIQGFFIA	GNTVHANYIF	WRNSTIMSLS	YNSVLDLSKF	ECKHKATVVV
229E	EAFVVGINYL	GDFAQGFFID	GNIHANYVF	WRNSTVMSLS	YNSVLDLSKF	NCKHKATVVV
PEDV	EAFLLIGVHYL	GDFASGAVID	GNTMHANYIF	WRNSTIMTMS	YNSVLDLSKF	NCKHKATVVV
TGEV	EGFLIGINYL	GPYCDKAIVD	GNIHANYIF	WRNSTIMALS	HNSVLDTPKF	KCRCNALIV
BoCoV	EGFLIGINYL	GK--PKVEID	GNVMHAIICF	G-----	-----	EIPQFGTGLV
OC43	EGFLIGINYL	GK--PKVEID	GNVMHANYLF	WRNSTVWNGG	AYSLFDMAKF	PLKLAGTAVI
MHV	EGFLIGINYL	NR--TRTEID	GKTMHANYLF	WRNSTMWNGG	AYSLFDMSKF	PLKVAGTAVV
AIPV	EAFLLIGVNYL	GAS-EKVVS	GKTLHANYIF	WRNCNYLQTS	AYSIFDVAKF	DLRLKATPVV
SARS CoV	EAFLLIGANYL	GK--PKEQID	GYTMHANYIF	WRNTNPIQLS	SYSLFDMSKF	PLKLRGTAVM

	2765	2775	2785	2795
EMCR	TLKDSVDNDM	VLSLIKSGRL	LLRNSGRFGG	FSNHLVSTK-
229E	QLKOSDINEM	VLSLVRSGKL	LVRGNGKCLS	FSNHLVSTK-
PEDV	NLKDSISIDV	VLGLLRNGKL	LVRNDAICG	FSNHLVNVNK
TGEV	NLKEKELNEM	VIGLLRKGKL	LIRNNGKLLN	FGNHVNTNP-
BoCoV	IACLWLNSR	LSNVLMP---	-----	-----
OC43	NLRADQINDM	VYSLLEKSGKL	LIRDTNKEVF	VGDSLNVVI-
MHV	SLKPDQINDL	VLSLIEKSGKL	LVRDTRKEVF	VGDSLNVVK-
AIPV	NLKTEQKTDL	VFNLIKCGKL	LVRDVGNTSF	TSDSFVCTM-
SARS CoV	SLKENQINDM	IYSLLEKSGRL	IIRENNRVVV	SSDILVNN--

d. Putative Orf lab

	5	15	25	35	45	55
EMCR	-----	-----	-M FYNQVTLAVA	SDSEISGFGF	AIPSVAVRAY	SEAAAQGFQA
229E	-----	-----	-M ACNRVTLAVA	SDSEISANGC	STIAQAVRRY	SEAAASNGFRA
PEDV	-----	-----	-M ASNHVTLAFA	NDAEISAFGF	CTASEAVSY	SEAAAAGFMQ
TGEV	-----	-----	-M SSKQFKILVN	EDYQVNVPSL	PIR-DVLQEI	KYCYRNGFEG
OV43	MSKINKYGLE	LHWAPEFPWM	FEDAEEKLDN	PSSSEVDMIC	STTAQKLETG	GICPENHVMV
BoCoV	MSKINKYGLE	LHWAPEFPWM	FEDAEEKLDN	PSSSEVDIVC	STTAQKLETG	GICPENHVMV
MHV	MAKMGKYLGL	FKWAPEFPWM	LPNASEKLGS	PERSEEDGFC	PSAAQEPKTK	GKTLINHVRV
AIBV	-----	-----	MASSLRQGVV	PKPRDVILVS	KDIPEQLCDA	LFFYTSHNPK
SARS CoV	-----	-----	MESLVLGV	NEKTHVQLSL	PVLQVRDVLV	RGFSDSVEEA
						LSEAREHLKN
	65	75	85	95	105	115
EMCR	CRFVAFGLQD	CVTGINDDDY	VIALTG----	-----	TNQLCAKILL	FSDRPLNLRG
229E	CRFVSLDLQD	CIVGIADDDY	VMGLHG----	-----	NQTLFCNIMK	FSDRPFMLHG
PEDV	CRFVSLDLAD	TVEGLLPEDY	VMVVG----	-----	TTKLSAYVDT	FGSRPRNICG
TGEV	YVVFPEYCRD	LVDGDRKDHV	VIGVLG----	-----	NGVSDLKPEVL	LTEPSVMLQG
OV43	DCRRLLKQEC	CVQSSLIIEI	VMNASPYDLE	VLLQDALQSR	EAVLVTPLG	MSLEACYVRG
BoCoV	DCRRLLKQEC	CVQSSLIIEI	VMNTRPYDLE	VLLQDALQSR	EAVLVTPLG	MSLEACYVRG
MHV	DCSRLPALEC	CVQSAIIRDI	FVDEDPLNVE	ASTMMALQFG	SAVLVKPSKR	LSIQAWAKLG
AIBV	DYADAFVAVRQ	KFDRSLQTGK	QFKFET----	-----	CGLFLLKGVD	KITPGVPAKV
SARS CoV	GTCGLVELEK	GVLPQLEQPY	VFIKR--SDA	LSTNHGHKVV	ELVAMDGIQ	YGRSGITLGV
	125	135	145	155	165	175
EMCR	WLIFSNSNYV	LQDFDVVFG-	-HGAGSVVVF	DKYMGCFDGK	PVLP--KNMW	EFRDYFNDNT
229E	WLIFSNSNYL	LEEDFVDFGK	-RGGGNVTYT	DQYLCGADGK	PVMS--EDLW	QFVDHFGENE
PEDV	WLLFSNCFNYF	LEELELTFFG-	-RRGGNIVPV	DQYMGADGK	PVLQ--ESEW	EYTDFFADSE
TGEV	FTVRANCNGV	LEDFDLKIA-	-RTGRGAIYV	DQYMGADGK	PVIE--G---	DFKDYFGDED
OV43	CNPKGWTMGL	FRRRSVCNTG	RCTVNKHVAY	QLYMIDPAGV	CLGAGQFVGW	VIPLAFMPVQ
BoCoV	CNPNKWTMGL	FRRRSVCNTG	RCAVNKHVAY	QLYMIDPAGV	CFGAGQFVGW	VIPLAFMPVQ
MHV	VLPKTPAMGL	FKRFLCNTR	ECVCDAHVAF	QLFTVQPDGV	CLGNRFIGW	FVPVTAIPAY
AIBV	LKATSKLADL	EDIFGVSPLA	RKYRELLKTA	CQWSLTVEAL	DVR-----AQ	TLDEIFDPTV
SARS CoV	LVPHVGETPI	AYRNVLLRK-	--NGNKGAGG	HSYGIDLKSY	DLG--DELGT	DPIDYEQNW
	185	195	205	215	225	235
EMCR	DS-IVIGGVV	YQLAWDVIRK	DLSEYQQNVL	AIESIHVYLG-	TTGHTLKS GC	KLINAKPPKY
229E	E--IIINGHT	YVCAWLTKRK	PLDYKRQNNL	AIEEIEYVHG	DALHTLRNGS	VLEMAKEVKT
PEDV	DGQLNIAGIT	YVKAIVERS	DVSYASQNL	SIKSITYCS-	TYEHTFLDGT	AMKVARTPKI
TGEV	--IIEFEGEE	YHCAWTTVRD	EKPLNQQTFL	TIQEIQYNL-	DIPKHLNCA	TRHVAPPVKK
OV43	SRKFIVPVWM	YLRKRGEKGA	YKNDHGRGGF	GH-VYDFKVE	DAYDQVHDEP	KGKFSKKAYA
BoCoV	SRKFIVPVWM	YLRKRGEKGA	YIKDYKRGGF	EH-VYNFKVE	DAYDLVHDEP	KGKFSKKAYA
MHV	AKQWLQFWSI	LLRKGGNKG	VTSGHFRRAV	TMPVYDFNVE	DACEEVHLNP	KGKYSRKAYA
AIBV	ILWLQVAAKI	HVSSMAMRRL	VGEVTAQVMD	ALG-----	SNLSALFQIV	KQIARIQFK
SARS CoV	NTKHGSGALR	ELTRELNNGA	VTRYVDNNEC	GPBGYPLDCI	KDFLARAGKS	MCTLS-EQLD
	245	255	265	275	285	295
EMCR	SSKVVLSGEW	NAVYKAFGSP	FITNGISLLD	IIVKPVFFNA	FVKCNCGSEN	WSVGAWDGYL
229E	SSKVVLSDAL	DKLYKVFSGP	VMTNGSNILE	AFTKPVFISA	LVQCTCGTKS	WSVGWDWTFK
PEDV	KKNVVLSEPL	ATIIYREIGSP	FVDNGSDARS	IIRRPVFLHA	FVKCKCGSYH	WTVGDWTSYV
TGEV	NSKIVLSEDY	KKLYDIFGSP	FMGNGDCLSK	CFDTLHFIAA	TLRCPGCGSES	SGVGDWTFK
OV43	LIRGYRGVGP	LLYVDQYQCD	YTGLADGLE	AYADKTLQEM	KALFPTWSQE	LLFDVIVAWH
BoCoV	LIRGYRGVGP	LLYVDQYQCD	YTGLADGLE	AYADKTLQEM	KALFPIWSQE	LPFDVTVAWH
MHV	LLKGYRGVKS	ILFLDQYQCD	YTGLAKGLE	DYGDCTLEEM	KELFPVWCDS	LDNEVVVAWH
AIBV	ALAI FENVNE	LPQRIAAALM	AFAKCARSIT	VVVVERTLVV	KEFAGTCLAS	INGAVAKFFE
SARS CoV	YESKRGVYC	CRDHEHEIAW	FTERSDKSYE	HQTPFEIKSA	KKFDTFRGEC	PKFVFPLNSK
	305	315	325	335	345	355
EMCR	SSCCGTPAKK	LCVVPGNVVP	GDVIITSTDA	GCGVKYYAGL	VVKHITNITG	VSLWRVTAVH
229E	SSCCNVISNK	LCVVPGNVVP	GDAVITTQQA	GAGIKYFCGM	TLKEVANIEG	VSVMRVIALQ
PEDV	STCCGFKCKP	VLVASCASMP	GSVVVTRAGA	GTGVKYYNMM	FLRHVADIDG	LAFWRILKVO
TGEV	TACCGLSGKV	KGVTLDGIKP	GDAVVTMSA	GKGVKEFFANC	VLQYAGDVEG	VSIIWKVITF
OV43	VVRDPYRVMR	LQSAATIRSV	AYVANPTEDL	CDGSSVVIKEP	VHVYADDSII	LRQYNLVDIM
BoCoV	VVRDPYRVMR	LQSAATIRSV	AYVANPTEDL	CDGSSVVIKEP	VHVYADDSII	LRQYHNVDIM
MHV	VDRDPRAVMR	LQTLATIRSI	GYVGQPTEDL	VOGDVVVREP	AHLAANAIV	KRLPRLVETM
AIBV	ELPNFGMGSK	IFTTLAFFKE	AARVVVENIP	NAPRGTKGFE	VVGNAKGTQV	VVRGMRNDLT
SARS CoV	VKVIQPRVEK	KKTEGFMGRI	RSVYPVASPO	ECNNMHLSTL	MKCNHCDEVS	WQTCDFLKA

	365	375	385	395	405	415
EMCR	SDGMFVATSS	YDALLHRNSL	DPFCFDVNTL	LSNQLRLAFL	GASVTEDEVKF	A-----AST
229E	SVDCFVASST	FVEEEHVNRN	DTFCFNVNRN	VTDECRLAML	GAEMTSNVRR	Q-----VAS
PEDV	SKDDLACSGK	FLEHHEEGFT	DPYFLNDSS	LATKLKFDIL	SGKFSDEVKQ	A-----IIA
TGEV	TVDETVCPTG	FEGLN----	DFIKPESKSL	VACSVKRAFI	TGDIIDAVHD	C-----IIT
OV43	SHFYMEADTV	VNAFYGVALK	DCGFVMQFGY	IDCEQDSCDF	KGWIPGNMID	G---FACTTC
BoCoV	SCFYMEADAV	VNAFYGVDLK	DCGFVMQFGY	IDCEQDLCDF	KGWVPGNMID	G---FACTTC
MHV	LYT---DSSV	TEFCYKTKLC	DCGFITQFGY	VDCCGDACDF	RGWVPGNMMD	G---FLCPGC
AIBV	LLDQKADIPV	EPEGWS----	--AILDGHLK	YVFRSGDRFY	AAPLSGNFAL	S-----
SARS CoV	CEHCGTENLV	IEGPTTCGYL	PTNAVVKMPC	PACQDPEIGP	EHSVADYHNH	SNIETRLRKG

	425	435	445	455	465	475
EMCR	GVIDISAGMF	GLYDDILTNN	KPWFVRKASG	LFDAIWDAFV	AAIKLVPTTT	GGLVRFVKSI
229E	GVIDISTGWF	DVYDDIFAES	KPWFVRKAED	IFGPCWSALA	SALKQLKVTT	GELVRFVKSI
PEDV	GHVVVGSALV	DIVDDALG--	QPWFIRKLG	LASAPWEOLK	AVVRGLGLLS	DEVVLFGRRL
TGEV	GKLDLSTNLF	GNVGLLFKK-	TPWFVQKCGA	LFVDANKVVE	ELCGSLTLTY	KQIYEVVASL
OV43	GHVYEVGLDI	AQSSGVLPVN	PVLHTKSAAG	YGGFGCKDSF	TLYGQTVVYF	GGCVYWSPAR
BoCoV	GHVYETGDLI	AQSSGVLPVN	PVLHTKSAAG	YGGFGCKDSF	TLYGQTVVYF	GGCVYWSPAR
MHV	SKSYMPWELE	AQSSGVIPKG	GVLFQTQSTDT	VN----RESE	KLYGHAVVPF	GSAYVWSPYP
AIBV	-DVHCCERVV	CLSDGVTP--	--EIN--DGL	ILAAIYSSFS	VSELVTALKK	GEPFKFLGHK
SARS CoV	GRTRCFGCGV	FAYVGYNCR	AYWVPRASAD	IG----SGHT	GITGDNVETL	NEDLLEILSR

	485	495	505	515	525	535
EMCR	ASTVLTVSNG	VIIMCADVPD	AFQPVYRTFT	QAICAAFDPS	LDVFKIG--	-----
229E	CNSAVAVVGG	TIQILASVPE	KFLNADFVVF	TAIQTVDCA	VETCTIA--	-----
PEDV	SCATLSIVNG	VFEFLADVPE	KLAAAVTVVF	NFLNEFFESA	CDCLKVGG	-----
TGEV	CTSAFTIVNY	KPTFFVVPD-N	RVKDLVDKCV	KVLVRAFDVF	TQIITIAG--	-----
OV43	NWIPIILKSS	VKSYSLSVYT	GVLGCKAIVK	ETNLICKALY	LDYVQHKCGN	LHQRELLGVS
BoCoV	NWIPIILKSS	VKSYSLSVYT	GVVGCKAIVK	ETNLICKALY	LDYVQHKCGN	LHQRELLGVS
MHV	GMWLPIVWSS	VKSADLTLYT	GVVGCKAIVQ	ETDAICRSLY	MDYVQHKCGN	LEQRAILGLD
AIBV	---FVYAKDA	AVSFTLAKAA	TIADVLRFLQ	SARVIAEDVW	SSFTEKS--	-----
SARS CoV	---ERVNINI	VGDFHLNEEV	AIILASFAS	TSAFIDTIKS	LDYKSFKT-I	VESCGNYKVT

	545	555	565	575	585	595
EMCR	---DVKEFR	LGDYVLTENA	LVRLTTEVVR	GVRD-----	-----	A-----
229E	---GKAFDK	VFDYVLLDNA	LVLVTTKLK	GVR-----	-----	R-----
PEDV	---GKTFNK	VGSYVLFDNA	LVLKLVKAKAR	GPRQ-----	-----	A-----
TGEV	---IEAKCFVL	GAKYLLFNNA	LVLKLVSVKIL	GKKQ-----	-----	K-----
OV43	DVWHKQLLN	RGVYKPLEN	IDYFNMRRAK	FSLETFT---	VCADGFMPFL	LDDLVPRAYY
BoCoV	DVWHKQLLN	RGVYKPLEN	IDYFNMRRAK	FSLETFT---	VCADGFMPFL	LDDLVPRAYY
MHV	DVYHQLLVN	RGDYSLLLEN	VDLFVKRRAE	FACK-FA---	TCGDGLVPLL	LDGLVPRSY
AIBV	-----	FEWKLAYGK	VRNLEEFVKT	YVCK-----	-----	-----
SARS CoV	KGKPKVGAWN	IGQORSVLTP	LCGFPSQAAG	VIRSIFARTL	DAANHSIPDL	QRAAVTILDG

	605	615	625	635	645	655
EMCR	-RIKKAMETK	VVVGPTTEVK	FSVIELATVN	LRLVDCAPVV	CPKGKIVVIA	GQAFFVSGGF
229E	-GLNKVYAT	VVVGSTEEVK	SSRVERSTAV	LTIANNSYKL	FDEGYTVVIG	DVAYFVSDGY
PEDV	-GICEVRYTS	LUVGSTTKVV	SKRVENANVN	LVVVDEDVTL	NTTGRTVVVD	GLAFFESDGF
TGEV	-GLECAFEAT	SLVGATVNV	PKRTETATIS	LNVVDDVVAP	G-EGYIVIVG	DMAFYKSSEY
OV43	LAVSQGAFC	YADKLCHAVV	SKSKELLDVS	LDSLGAIIHY	LNSKIVDLAQ	HFSDFGTSFV
BoCoV	LAVSQGAFC	YAGKICHAVV	SKSKELLDVS	VDSLGAIIHY	LNSKIVDLAQ	HFSDFGTSFV
MHV	LKSKGAFTS	MMVNFSEHVT	DMCMDMALLE	MHDVKVATKY	VKKVTGKLAV	RFKALGVAVV
AIBV	AQMSIVILAA	VLGEDIWHLV	SOVIYKLGVL	FTKVVDFCDK	HWKGFVCQLK	RAKLIVTETF
SARS CoV	ISEQSLRLVD	AMVYTSDDL	NSVIIMAYVT	GGLVQOTSQW	LSNLLGTTFE	KLRPIFEWIE

	665	675	685	695	705	715
EMCR	YRFVVDSTTV	LNDPVFTGEL	FYTIKFSGFK	LDGFN-----	---HQFVNAS	SATDAIIAVE
229E	FRLMASPNVS	LTTAVYKPLF	AFNVNVMGTR	PE-----	---KFPTTV	TENLESABL
PEDV	YRHLADADV	IEHPVYKSAC	ELKPVFECDP	IP--D-----	---FPLPVAA	SVAELCVQTD
TGEV	YFMMSSPNFV	LTNNVFKAVK	VPSYDIVYDV	DNDTKSKMIA	KLGSSEFYDG	DIDAIVKVN
OV43	SKIVHFFKTF	TTSTALAFW	VLHVLHGAY	IVVESDIYFV	KN-IPRYASA	VAQAFQSVAK
BoCoV	SKIVHFFKTF	TTSTALAFW	VLHVLHGAY	IVVESDIYFV	KN-IPRYASA	VAQAFQSVAK
MHV	RKITEWFDLA	VDTAASAAGV	LCYQLVNGLF	AVANGGITFL	SD-VPELVKN	FVDKPKVFFK
AIBV	CVLKGVAQHC	FQLLLDAIHS	LYKSFKKCAL	GRING-----	---DLLFWKGG	VHKIVQDGE
SARS CoV	AKLSAGVEFL	KD-----AWE	ILKFLITGVF	DIVKGQIQVA	SDNIKDCVKC	FIDVVRKALE

	725	735	745	755	765	775
EMCR	LLSDFKITAV	FVYTCVVDCG	SVIVRRDAT-	FATHVCFKDC	YSIWEQFCID	NCGE-----
229E	FVNKITEFQ	LDYSIDVIDN	EIIKPNIS-	LCVPLYVRDY	VDKWDFFCRQ	YSNE-----
PEDV	LLLNKYNTPY	KTYSCVVRGD	KCCITCTLQ-	FKAPSYVEDA	VN-FVDLCTK	NIGT-----
TGEV	ELLIEFRQOS	LCFRAFRDDK	SIFVEAYFKK	YKMPACLAKH	IG-LWNIIKK	DSCK-----
OV43	VVLDSLRTVF	IDGLSCFKIG	RRRICLSGRK	IYEVEG-LL	HSSQLPLDVO	DLTMSQVQK
BoCoV	VGLDSLRTVF	IDGLSCFKIG	RRRICLSGSK	IYEVEG-LL	HSSQLPLDVO	DLTMSQVQK
MHV	VLDMSVSVS	LSGLTVVKT	SNRVCLAGCK	VYEVQK-RL	SAVYMPVGCN	EATC-----
AIBV	IWFDAIDSVD	VEDLGVVQEK	SIDFEVCDV	TLPENQPGHM	VQIEDDGKNY	MEFR-----
SARS CoV	MCIDQVTIAG	AK-LRSLNLG	EVFIAQSKGL	YRQCIRGKEQ	LQLLMLPKAP	KEVT-----

	785	795	805	815	825	835
EMCR	-----PW	FLTDYNAILQ	SNNPQCAIVQ	ASESK-----	--VLLERFLP	KCP EILLSID
229E	-----SW	FEDDYRAFIS	VLDITDAAVK	AAESK-----	--AFVDTIVP	PCPSILKVID
PEDV	-----AG	FHEFYITAHE	QDLQGFLLT	CCTMSG-----	F-ECFMPTIP	QCPAVLEEID
TGEV	-----RG	FLNLFNHLNE	LEDIKETNIQ	AIKN-----	-----I-	LCPDPLLDLD
OV43	AKQKPIYLLG	SGSDFSLADS	VVEVVTTSLT	PCG-----YS	EPPKVADKIC	IVDNVYMAKA
BoCoV	TKQKGIYLLG	SGSDFSLADS	VVEVVTTSLT	PCG-----YS	EPPKVADKIC	IVDNVYMAKA
MHV	-----LVG	EIEPAVVEDD	VVDVVKAPLT	YQG-----CC	KPPTSFEKIC	VVDKLYMAK
AIBV	-----FKK	DENIYYTPMS	QLGAINVVCK	AGG-----	-----KTVT	FGETTVQEIIP
SARS CoV	-----FLEG	DSHDTVLTS	EVVLKNGELE	ALETFPVDSFT	NGAIVGTPVC	VNGLMLLEIK
	845	855	865	875	885	895
EMCR	DGHLWNLFVE	K-----	-FNFVTDWLK	TLKLTLSNG	LLGNCAKFR	RVLVKLLDVOY
229E	GGKIWNNGVIK	N-----	-VNSVRDWLK	SLKLNLTQQG	LLGTCAKRFK	RWLGILLEAY
PEDV	GGSTWRSFIT	G-----	-LNTMWDCK	RLKVSFGLDG	IVVTVARFKF	RLGALLAEMY
TGEV	YGAIWYNCMP	G-----	-CSDP-SVLG	SVQLLIGNG-	-VKVVCDCGK	GFRANQLSKGY
OV43	GDKYYPVVVD	-DHVGLLDQA	WRVPCAG--R	RVTFEQPTV	KEIISMPKII	KVFYELDNDF
BoCoV	GDKYYPVVVD	-GHVGLLDQA	WRVPCAG--R	CVTFKEQPTV	NEIASTPKTI	KVFYELDKDF
MHV	GDKYYPVVVD	NDTIGVLDQC	WRVPCAG--K	KVEFNDKPKV	KEIPST-RKI	KINFALDQTF
AIBV	PPDVVPIKVS	-----	-IECCG--E	PWNTIFKRAY	KEPIEVDL	TVEQLLSVIY
SARS CoV	DKEQYCALSP	--GLLATNNV	FRLKGGAPIK	GVTFG-EDTV	WEVQGY-KNV	RITFELDERV
	905	915	925	935	945	955
EMCR	NGFLETVCVS	VHTAGVCIKY	YAVNVP-YVY	ISGFVSRVIR	RERCD--VTF	PCVSCVTFFY
229E	NAFLDTVVST	VKIGGLTFKT	YAFDKP-YIV	IRDIVCKVEN	KTEAEWIELF	PHNDRIKSF
PEDV	NTYLSTVVEN	LVLAGVSFKY	YATSVP-KIV	LGGCFHSVKS	VFAV--FQI	PVQAGIEKFK
TGEV	NKLCNAARND	IEIGGIPFST	FKTPTNTFIE	MTDAIYSVIE	QGKALS----	-----
OV43	NTILNTACGV	FEVDDTVME	EYAVVIDAI	EELKSPCKEL	EGVGAKVSAP	LQKLEDNPLF
BoCoV	NTILNTACGE	FEVDDTVME	EYAVVIDAI	EELKSPCKEL	EGVGAKVSAP	LQKLEDNPLF
MHV	DSVLSKACSE	FEVDDTVME	ELLDVVDLDAV	ESTLSPCKEH	DVIGTKVCAL	LNRLAEDYVY
AIBV	EKMCDLKL	PEAPEPPPE	NVALVDKNGK	DLDCIKSCHL	IYR-----	-----
SARS CoV	DKVLNEKCSV	YTVESGTEVT	EFACVVAEAV	VKTLPVSDL	LTN---MGID	LDEWSVATFY
	965	975	985	995	1005	1015
EMCR	EFLDTCFGVS	K----PNAID	VEHLEKETE	FVEPKDGGQF	FVSDDYLWYV	V-DDIYYPAS
229E	TFESAYMPIA	D----PTHFD	IEEVELLDAE	FVEPGCGGIL	AVIDEHVYFK	K-DGVYYPNS
PEDV	VFLNCVHPVV	-----PRVIE	TSEVELEET	EKPPALNGGI	AIVDGFAYFY	D-GTLYYPTD
TGEV	-FRADVPVV	DNGTISTADW	SEPILLEPAE	YVKKNNGNV	IVIAGTYFYK	DEDEHPYFG
OV43	LFDEAGEEVL	APKLYCAFTA	P--EDDDFLE	ESDVEEDDVE	GEETDLTVTS	AGQPCVASEQ
BoCoV	LFDEAGEEVL	APKLYCAFTA	P--EDDDFLE	ESGVEEDDVE	GEETDLTVTS	AGEPCVASEQ
MHV	LFDEEGEEVI	APKMYCSFSA	P--DDEDCVA	ADVVDADENQ	GDDADDSAAL	VTDTQEEDGV
AIBV	-DYESDDDIE	E-----ED-	AECDTDSGE	AECDTNSSEC	EEDEEDTKVL	ALIQDPASIK
SARS CoV	LFDDAGEENF	SSRMYSFYF	PDEEEDDAE	CEEEIDETC	EHEYGTEDDY	QGLPLEFGAS
	1025	1035	1045	1055	1065	1075
EMCR	CNGVLPVAF	KLGGK--IS	FSDDVIVHDV	EPHVKVLIF	EFE-----	-----DDVVT
229E	GTNLPVAF	KAAGK--VS	FSDDVEVKDI	EPVYRKLCE	EFE-----	-----DEKLV
PEDV	GNSVVPICFK	KKGGD--VK	FSDEVSVKTI	DPVYKVSLEF	EFE-----	-----SETIM
TGEV	FGKIVQRMYN	KMGGDGKTVS	FSEEDVQEI	APVTRVRLEF	EFD-----	-----NEIVT
OV43	EESSEVLEDT	LDDGPSVETS	DSQVEEDVEM	SDFVLESVI	QD-----	-----YENVCF
BoCoV	EESSEILEDT	LDDGPCVETS	DSQVEEDVQM	SDFGLESVI	QD-----	-----YENVCF
MHV	AKGQGVVAES	DARLDQVEAF	DIEKVEDPIL	NELSAELNAP	ADKTYEDVLA	FDIAYSEALS
AIBV	YPLPLDEDYS	VYNGCIVHKD	ALDVNLPSG	EETFEVNNCF	EG-----	-----AVK
SARS CoV	AETVRVEEEE	EEDWLDDTTE	QSEIEPEPEP	TPEEPVNQFT	CYLK-----	-----LTDNVAI
	1085	1095	1105	1115	1125	1135
EMCR	SLCKK-----	-----S	FGKSIITG-	DWGLHEVLT	SAMNVIG---	---QHILPQF
229E	DVCEK-----	-----A	IGKKIKHEG-	DWDSFCKTIQ	SALSVVS---	---CYVNLPTY
PEDV	AVLNK-----	-----A	VGNRIKVTG-	GWDDVVEYIN	VAIEVLK---	---DHVEVPKY
TGEV	GVLER-----	-----A	IGTRYKFTGT	TWEEFEESIS	EELDAIFDTL	ANQGVELEGY
OV43	EFTYTT--EPE	FVKVLGLYVP	K--ATRNNCW	LRSVLAVMQK	LPCQFKDKNL	QDLWVLYKQQ
BoCoV	EFTYTT--EPE	FVKVLGLYVP	K--ATRNNCW	LRSVLAVMQK	LPCQFKDKNL	QDLWVLYKQQ
MHV	AFYAVPGDET	HFVCGFYSP	A--IERTNCW	LRSTLIVMQS	LPLEFKDLEM	QKLWLSYKSS
AIBV	PLPQK-----	-----	-----VVDVLG	DWGEAVDAQE	QLCQQEP---	---LQHTFE
SARS CoV	KCDIVKEAQ	SANPMVIVNA	ANIHLKHGGG	VAGALNKATN	GAMQRESDDY	IKLNGPLTVG
	1145	1155	1165	1175	1185	1195
EMCR	YIYDEEGGYD	VSKP--VMIS	QWPISSDDSG	CVVEASTDFH	Q--LESVREE	VD-----
229E	YIYDEEGGND	LSLP--VMIS	EWPLSVQQAQ	QEATLPDIAE	D--VVDQVEE	VNS-----
PEDV	YIYDEEGGTD	PNLP--VMIS	QWPLNDTIS	QDLLOVEVVT	DAPIIDEGDE	VDSSAFKVA
TGEV	FIYDTCGGFD	IKNPDMGIMIS	QYDINITADE	KSEVSASSE	EE--VESVEED	PENEIVEASE
OV43	YSQLFVDTLV	NKIPANIVLP	QGGYVADFAY	WFLTLCDWQC	VAYWRCIKCD	LALK---LKG
BoCoV	YSQLFVDTLV	NKIPANIVVP	QGGYVADFAY	WFLTLCDWQC	VAYWRCIKCD	LALK---LKG
MHV	YNKEFVDKLV	KSVPKSIILP	QGGYVADFAY	FFLSQCSFKA	YANWRCLKCD	MDLK---LQG
AIBV	EPVENSTGSS	KTMTQEVVVE	DQELPVVEQD	QDVVVYPTD	LEVAKETAEE	VD-----
SARS CoV	GSCLLSGHNL	ARKCLHVVG	NLNAGEDIQ	LKAAYENFNS	QDILLAPLLS	AGIFG--AKP

	1205	1215	1225	1235	1245	1255
EMCR	-----	-----	-----IIE	QPFGEVEHAL	SIRQ-----	---PFSFSFR
229E	-----	-----	-----IFD	IETVDVKHDV	S-----	---PFEMPFE
PEDV	-----D	VANSEPGDDG	LPVAPETNVE	SEVEEVAATL	SFIKOTPSTV	TKDPFAFDV
TGEV	GAEGTSSQEE	VETVEVADIT	STEEDVDIVE	VSAKDDPWAA	AVDVQEAQEQ	NPSLPPFKTT
OV43	LDAMFFYGDV	VSHICKCGES	MVLIDVDVVF	TAHFALKDKL	FCAFITKRIV	YKAACVVDVN
BoCoV	LDAMFFYGDV	VSHVCKCGES	MVLIDVDVVF	TAHFALKDKL	FCAFITKRIV	YKAACVVDVN
MHV	LDAMFFYGDV	VSHVCKCGTG	MTLLSADIPY	TLHFGLRDDK	FCAFYTPRKV	FRAACVVDVN
AIBV	-----	-----	-----EFIL	IFAVPKKEEV	S-----	-----QKDG
SARS CoV	LQSLQVCVQT	VRTQVYIAVN	DKALYEQVVM	DYLDNLKPRV	EAPKQEEPPN	TEDSKTEES

	1265	1275	1285	1295	1305	1315
EMCR	DELGVRVLQ	SDNNCWIST	LIQLQLTKLL	DDSIEMQLFK	VGVVDSIVQK	CYELSHLISG
229E	ELNGLKILKQ	LDNNCWVNSV	MLQIQLTGIL	DGDYAMQFFK	MGRVAKMIER	CYTAQCIRG
PEDV	SYGGGLKVLQ	SHNNCWVST	LVQLQLLGIV	D-DPAMELFS	AGRVGPMVRK	CYESQKAILG
TGEV	NLNGKIILKQ	GDNNCWINAC	CYQLQAFDFF	N-NEAWERFK	RGDVMDVFNL	CYAAATTLARG
OV43	DSHSMVAVDG	KQIDDDHRITS	ITSDKFDFFI	G-HGMSFSMT	TFEIAQLYGS	CITP-NVCFV
BoCoV	DSHSMVAVDG	KQIDDDHRITS	ITSDKFDFFI	G-HGTSFSMT	TFEIAQLYGS	CITP-NVCFV
MHV	DCHSMVAVDG	KQIDGKVVTK	FNGDKYDFMV	G-HGMAFSMS	AFEIAQLYGS	CITP-NVCFV
AIBV	QIKQEPQVQV	KPQREKKAKK	FKVKPATCEK	P-----K-	FLEYKTCVGD	LTVVIAKALD
SARS CoV	VVQRPVDVKP	KIKACIDEVT	TTLEETKFLT	N-KLLLFADI	NGKLYHDSQN	MLRGEDMSFL

	1325	1335	1345	1355	1365	1375
EMCR	SLGDSGKLLS	ELLKDKYTCS	ITFEMSCDCG	KKFDEQVGL	FWIMPYTKLF	QKGECCICHK
229E	AMGDVGLCMY	RLKDLHTGF	MVMYKCSCT	SGRLEESGAV	LFCTPTKKA	PYGTCLNCNA
PEDV	SLGDVSACLE	SLTKDLHTLK	ITCSVVCGCG	TGERIYEGCA	FRMTPTLEPF	PYGACAQCAQ
TGEV	HSGDAEYLL	LMNDYSTAK	IVLAACKCGC	EKEIVLERAV	FKLTPLKESF	NYGVCDCMQ
OV43	RGDIKIVSKL	VKAEEVVNPA	NGHMAHGGGV	AKAIAVAAGQ	QFVKETDMV	KSKGVCATGD
BoCoV	RGDIKIVSKR	VKAEEVVNPA	NGHMAHGGGV	AKAIAVAAGQ	QFVKETDMV	KSKGVCATGD
MHV	RGDVIKVLRR	VGAEEIVNPA	NGRMAHAGAV	AGAIKAAGK	SFIKETADMV	KNQGVCCVGE
AIBV	EKFECFIVNA	ANEHMHGSG	VAKAIADFCG	LDFVEYCEDY	VKKHGPQQR	VTPSFVKGIQ
SARS CoV	EKDAPYVMVG	VITSGDITCV	VIPSKKAGGT	TEMLSRALKK	VPVDEYITTY	PGQGCAGYTL

	1385	1395	1405	1415	1425	1435
EMCR	MQTYKLVSMS	GTGVFVQD--	PAPIDIDAF	VRPICSSVYL	GVRGSGHYQT	NLYSFDKAID
229E	PRMCTIRQLQ	GTIIIFVQK-	PEPVNPVSFV	VKPVCSIFR	GAVSCGHYQT	NIYSQNLCDV
PEDV	VLMHTFKSIV	GTGIFCRD--	TTALSLSL	VKPLCAAFFI	GK-DSGHYVT	NEYDAAMAID
TGEV	VNTRCFLSVE	SGSVFVHDIL	SKQTPEAMFV	VKPMHVVYT	GTQNGHYMV	DDIEHGYCVD
OV43	CYVSTGGKLC	KTVLNVVGP	ARTQGGKQSY	LLERVYKHLN	NYDCVVTTLI	SAGIFSVPD
BoCoV	CYVSTGGKLC	KTVLNVVGP	ARTQGGKQSY	LLERVYKHLN	KYDCVVTTLI	SAGIFSVPD
MHV	CYESTGGNLC	KTVLNVVGP	ARGHGKQCY	FLERAYQHIN	KCDVVTTLI	SAGIFSVPD
AIBV	CVNNVVGPRH	GONNLHEKLV	AAYKNVLVDG	VVNVVVPVLS	LGIFGVDFKM	SIDAMREAFE
SARS CoV	EEAKTALKKC	KSASFVLPSE	APNAKEEILG	TVSWNLREML	AHAETTRKLM	PICMDVRAIM

	1445	1455	1465	1475	1485	1495
EMCR	GFGVFDK--	-----	-----NSSV	NTVCFVDVDF	HS-VEIEAGE	VK-----
229E	GFGVFNKQP-	-----	-----WTNDAL	NTICIKDADY	NAKVEISVTP	IKNTVDTTPK
PEDV	GGRHQLK--	-----	-----YDTL	NTICVQDVNW	TAPLVPAVDS	VVEP-----
TGEV	GMGIKPLKKR	CYTSTLFINA	NVMTRAEPK	QEFKVEKVEQ	QPIVEENKSS	IEKEEIQSPK
OV43	VSLTYLLGTA	KQGVVLVSNN	QEDFDLISK	QITAVEG-TK	KLAARLSFNV	GRSIVYETDA
BoCoV	VSLTYLLGTA	KQGVVLVSNN	QEDFDLISK	QITAVEG-TK	KLAARLSFNV	GRSIVYETDA
MHV	VSLTYLLGVV	TKNVILVSNN	KDDFDVIEK	QVTSIAG-TK	ALSQQLAKNL	CRDVKFETNA
AIBV	GCTIRVLLFS	-----	-----LSQE	HIDYFDVTC	QKTIYLTEDG	VKYR-----
SARS CoV	ATIQRYKXGI	KIQEGIVDYG	VRFFFTYSKE	PVASIITKLN	SLNEPLVTMP	IGYVTHGFNL

	1505	1515	1525	1535	1545	1555
EMCR	-----	PFAVYKNVKF	YLGDISHLVN	CVSFDVFNNA	ANENLMHGGG	VARAIDILTE
229E	EEFVVKELN	AFLVHDNVAF	YQGDVDTVNV	GVDFDFIVNA	ANENLAHGGG	LAKALDVYTK
PEDV	-----VVK	PFSYKNVDF	YQGDVSDLVK	-LPCDFVNA	ANEKLSHGGG	IKAIDVYTK
TGEV	ND-----DLIL	PYFKAGKLSF	YQGALDVLIN	FLEPDVIVNA	ANGDLKHMGG	VARAIDVFTG
OV43	NKLILIN---	DVAFVSTFNV	LQDVLSLRHD	IADDDARTF	VQSNVDVVEE	GWRVNVKIFYQ
BoCoV	NKLILIN---	DVAFVSTFNV	LQDVLSLRHD	IADDDARTF	VQSNVDVVEE	GWRVNVKIFYQ
MHV	CDSLFS---	DSCFVSSYDV	LQEVLLRHD	IQDDDDARVF	VQAHMDNLPA	DWRLVNFDS
AIBV	-----	-----	-----SIVLKP	DSLQGFQGVY	AKNKIVFTAD	DVEDKEILYV
SARS CoV	EEAARCMR--	SLKAPAVSVV	SSPDVATTYN	GYLTSSSKTS	EEHFVETVSL	AGSYRDWSYS

	1565	1575	1585	1595	1605	1615
EMCR	GQLQSLSKDY	ISSNGPLKVG	AGVMLE--CE	KFN--VFNVV	GPRTG----	KHEHSLLVEA
229E	GKLQRLSKEH	IGLAGVKVVG	TGVMVE--CD	SLR--IFNVV	GPRKG----	KHERDLIKA
PEDV	GMLQKCSNDY	IKAHGPIKVG	RGVMLE--AL	GLK--VFNVV	GPRKG----	KHAPELLVKA
TGEV	GKLTERSKDY	LKKNSIAPG	NAVFFENVIE	HLS--VLNAV	GPRNGD----	SRVEAKLCNV
OV43	INGVRT-VKY	FECTGGIDIC	SQDKVFGYVQ	QGIFNKATVA	QIKALF----	LDKVDILLTV
BoCoV	INGVRT-VKY	FECPGGIDIC	SQDKVFGYVQ	QGSFNKATVA	QIKALF----	LDKVDILLTV
MHV	VDGVRT-VKY	FECPGEIFVS	SQKKKFGYVQ	NGSFKVASVS	QIRALL----	ANKVDVLCVT
AIBV	PTTDSKILEY	YGLDAQKYVI	YLQTLAQKWN	VQYRDNLIL	EWDRGN--CW	ISSAIVLLQA
SARS CoV	GQRTGLGVEF	LKRGDKIVYH	TLESPEVFLH	DG--EVLSD	KLKSLLSLRE	VKTIKVETTV

	1625 1635 1645 1655 1665 1675
EMCR	YNSILFENGI PLMPLLSGCI FGVRIENSLK ALFSCDINKP LQVFEVYSNE EQAVLKFLDG
229E	YNTINNEQGT PLTPILSCGI FGKLETSLE VLLDVCNTKE VKVFEVYTDTE VCKVRDFVSG
PEDV	YKSVFANSVG ALTPLISVGI FSVPLEESLS AFLACVGDRI CKCFYGDKE REAIKYMMDG
TGEV	YKAIACEGK ILTPLISVGI FNVRLTSLQ CLLKTVNDRG LNVFEVYTOQE RQTIENFFS-
OV43	DGVNFTNRFV PVGESFGKSL GNVFCDGVNV TKHKCDINYK GKVEFFQFDNL SSEDLKAVRS
BoCoV	DGVNFTNRFV PVGESFGKSL GNVFCDGVNV TKHKCDINYK GKVEFFQFDNL SSEDLKAVRS
MHV	DGVNFRSCCV AEGEVFGKTL GSVFCDGINV TKVRCSAIHK GKVEFFQYSGL SAADLVAVTD
AIBV	AKIRFKGFLT EAWAKLLGGD PTDFVAVCYA SCTAKVGDFS DANWLLANLA EHFDADYTNA
SARS CoV	DNTNLHTQLV DMSMTYQQQF GPTYLDGADV TKIKPHVNHE GKTFFVLPSD DTLRSEAFEY

	1685 1695 1705 1715 1725 1735
EMCR	LDLTPVID-- -----DVDV V----- --KPRFVEGN FSFFDCG--- VNALDGD--IY
229E	LNVVQKVE-- -----QPKI EPKPVSVIKV APKPYRVDGK FSYFTED--- LLCVADKKPI
PEDV	LVDALFKEAL VDTTPVQEDV QQVSQKPVLP NFEPFRIEGA HAFYECNPEG LMSLGAD--KL
TGEV	
OV43	SFNFDQKELL AYYNMLVN-- CFKQVQVVG KYFTFKQANN NCFVNVSCLM LQSLHLTFKI
BoCoV	SFNFDQKELL AYYNMLVN-- CSKWQVVFNG KYFTFKQANN NCFVNVSCLM LQSLNLFKI
MHV	AFGEDEPQLL KYNNMLG-- MCKWPVVVCG NYFAFKQSNN NCYINVACLM LQHLNLFKHK
AIBV	FLKKRVSCN-----
SARS CoV	YHTLDESFLG RYMSALNH-- TKKWKFQVQV GLTSIKWADN NCYLSSVLLA LQQLEVKKFA

	1745 1755 1765 1775 1785 1795
EMCR	LLFTNSILML DKQGQL---- LDTKLNGILQ QAVLDYLATV KTVPAGNLVK LVVE--SCTIY
229E	VLFPTDMLTL DDRGLA---- LDNALSGVLS AAIKDCVDIN KAIPSGNLIK FDIG--SVVVY
PEDV	VLFNTSNLDF CSVGKC---- LNDVTSGALL EAINVFKKSN KTVPAGNCVT LDCANMISIT
TGEV	
OV43	VQWQEAWELEF RSGRPARFVA LVLAAGGFKF GDPADSRDFL RVVFSQVDLT GAICDFEAC
BoCoV	VQWQEAWELEF RSGRPARFVS LVLAAGGFKF GDPADSRDFL RVVFSQVDLT GAICDFEAC
MHV	VQWQEAWELEF RSGKPLRFVS LVLAAGGFKF NEPSDSTDFM RVVLRADLS GATCDFEVC
AIBV	
SARS CoV	PALQEAYYRA RAGDAANFCA LILAYSNKTV GELGQVRETM THLLQHANLE SAKRVLNVVC

	1805 1815 1825 1835 1845 1855
EMCR	M-CVVPISND LSFDMNLGRC VRKLNRLKTC VIANVPAIDV LKKLLSSLTL TVKFVVESNV
229E	M-CVVPSEKD KHLNNDVQRC TRKLNRLMCD IVCTIPADYI LPLVLSLTC NVSFVGLKA
PEDV	M-VVLPDPGD ANYDKNYARA VVKVSKLKGK LVLAVDATL YSKLS--HLS VLGFSVTPDD
TGEV	--CSIP-----
OV43	K-CGVKQEQR TGLDAVMHFG TLSREDLEIG YTVDCSCG-- --KKLIHCVRF DVPFLICSNT
BoCoV	K-CGVKQEQR TGLDAVMHFG TLSREDLEIG YTVDCSCG-- --KKLIHCVRF DVPFLICSNT
MHV	K-CGVKQEQR KGVDAVMHFG TLDKGLAKG YTIACTCG-- --NKLHVCTQL NVPFILCSNK
AIBV	--CGIKSYEL RGLACIQP-----
SARS CoV	KHCQKKTTL TGVEAVMYMG TLSYDNLKGT VSIPVCGR-- -DATQYLVQO ESSFVMSAP

	1865 1875 1885 1895 1905 1915
EMCR	MDVNDCKFND NVVLKITEDG INVKDVVES SKSLGKQLG- VVSDGVDSFE GVLP--INTD
229E	AEA-----K VITIKVTEG VNVHDVTVT DKSFEQQVG- VIADKDKDLS GAVPSDLNLS
PEDV	VER--FYANK SVVIKVTEDT RSVKAVKVES TATYQQIG- PCLVNDVTVT DNKP--VVAD
TGEV	--VN----- --VTEDN VNHERVSVSF DKTYGEQLKG TVVIKDKDVT NQLPSAFDVG
OV43	PASVKLPKG- VGSANIFIG- DKVGHYVHVK CEQSYQLYDA SNVKKVTDVT GKLSDCLYLK
BoCoV	PASVKLPKG- VGSANIFKG- DKVGHYVHVK CEQSYQLYDA SNVKKVTDVT GNLSDCLYLK
MHV	PEGKLPDD- VVAANIFTG- GSLGHYTHVK CKPKYQLYDA CNVSKVSEAK GNFTDCLYLK
AIBV	-----LLHFK TQYSNCPCTG ANNTDEVIEA SLPYLLLFAT DGPATVDCDE DAVG-----
SARS CoV	PAEYKLQGT FLCANEYTG YQCGHYTHIT AKETLYRIDG AHLTKMSEYK GPVTDVFPY-K

	1925 1935 1945 1955 1965 1975
EMCR	TVLSVAPEVD WVAFYGFKA ALFASLDVKP YGYPNDFVGG FRVLGTTDNN CWNATCIIIL
229E	ELLTKAIDVD WVEFYGFKA VTFATVDHSA FAYESAVVNG IRVLKTSNND CWNNAVCIAL
PEDV	VVAKVVPNAN WDSHYGFKA GEFHMLDHTG FTFPSEVVNG RRVIKTTDNN CWNVNTCLQL
TGEV	QKVIKADID WQAHYGFDA AAFSASSHDA YKFEVVTHSN FIVHKQTDNN CWINAICLAL
OV43	NLKQTFKSVL TTYLDDVKK IEYKPDLSQY YCDGGKYITQ RIIKAQFKTF EKVDGVYTNF
BoCoV	NLKQTFKSVL TTYLDDVKK IEYKPDLSQY YCDGGKYITQ RIIKAQFKTF EKVDGVYTNF
MHV	NLKQTFSSKL TTYLDDVKK VEYNPDLSQY YCESGKYITK PIIKAQFKTF EKVEGVYTNF
AIBV	TVVEVGSTNS GHICYTOAAG AFNDLAKDRK FGKSPYITA MYTRFAFKNE TSLPVAQSK
SARS CoV	ETSYTTTIKP VSYKLDGVTY TEIEPKLDGY YKKNAYYTE QPIDLVP-TQ PLPNASFDNF

	1985 1995 2005 2015 2025 2035
EMCR	QYLKPTFKSK GLNVLWNKFV TGDVGPFVVSF IYFITMSSKG QKGDAEALS KLSEYLISDS
229E	QYSKPHFISQ GLDAAWNKFV LGDVEIFVAF VYVVARLMKG DRGDAEDTLT KLSKYLANE
PEDV	QFARFRFKA GLQAMWESYC TGDVAMFVHV LYWLGTGVDK QPSDSENALN MLSKYIVPAG
TGEV	ORLKPQWKFV GVRGLWNEFL ERKTQGFVHM LYHISGVKKG EPGDAELMLH KLGLMDNDC
OV43	KLIG--HTVC DSLNAKLGF DSKFEVEYKI TEWPTATGDV VLATODLYVK RYERGCITFG
BoCoV	KLIG--HTVC DILNAKLGF DSKFEVEYKI TEWPTATGDV VLATODLYVK RYERGCITFG
MHV	KLVG--HSIA EKFNAKLGF CNSPTEYKI TEWPTATGDV VLASDDLYVS RYSGGCVTFG
AIBV	GKSKS--KED VSNLATSSKA SFDNLTDFFQ WYDSNIYESL KVQSPDNFD KYVSTTKED
SARS CoV	KLTCSTNKFA DDLNQMTGFT KP-ASRELSV TFFPDNLGNDV VAIDRHYSA SFKKGAKLLH

	2045	2055	2065	2075	2085	2095
EMCR	IVTLEQYSTC	DIC-----	-----KSTVV	EVKSAVVCAS	VLKDGCDVG-	-----
229E	QVQLEHYSSC	VECDAKF---	-----KNSVA	SINSAIVCAS	VKRQGVQVG-	-----
PEDV	SVTIERVTHD	GCC-----	-----CSKR	VVTAPVNNAS	VLKLGVEDG-	-----
TGEV	EIIIVTHTTAC	DKC-----	-----AKVE	KFVGPPVAAAP	LAIHGTDE--	-----
OV43	KPVIWLSHEK	ASLNSLT---	-----YFNRP	SLVDDNKFDV	LKVDDVD---	-----
BoCoV	KPVIWLSHEQ	ASLNSLT---	-----YFNRP	LLVDENKFDV	LKVDDVD---	-----
MHV	KPVIWLGHEE	ASLNSLT---	-----YFNRP	SVVCENKFNV	LPVDVSEPTD	KGPVPAALV
AIBV	SKLPLTLKVR	GIKS-----	-----VV	DFRSKDGFIY	KLTPDTD---	-----
SARS CoV	KPIVWHINQA	TTKTTFKPNT	WCLRLCWSTK	PVDTNSFEV	LAVEDTGMD	N-----

	2105	2115	2125	2135	2145	2155
EMCR	---FCPHRH	KLRSRVK---	-----	-----	-FVNGRVVIT	NVGEPIISQP
229E	---YCVHGI	KYYSRVR---	-----	-----	-SVRGRAIIV	SVEQLEPCAQ
PEDV	---LCPHGL	NYIGKVV---	-----	-----	-VVKGTITIV	NVGKPVVAPS
TGEV	---TCVHGV	SVNVKVT---	-----	-----	-QIKGTVAIT	SLIGPIIG--
OV43	---DGGDSS	ESGAKE---	-----	-----	TKEINIIKLS	GVKKPFKVED
BoCoV	---DGGDIS	ESDAKE---	-----	-----	PKEINIIKLS	GVKKPFKVED
MHV	TGALSGAATA	PGTAKEQKVC	ASDSVVDQVV	SGFLSDLSGA	TVDVKEVKLN	GVKKPIKVED
AIBV	-----	-----	-----	-----	--ENSKAPVY	YPVLDAISLR
SARS CoV	---LACESQ	QPTSEEVVEN	-----	-----	-PTIQKEVIE	CDVRTTEVVG

	2165	2175	2185	2195	2205	2215
EMCR	SKLLNGIAYT	TFS--GSFDN	GHYVVYDAAN	NAVYDGARLF	ASDLSTLAVT	AIVVVGGCVT
229E	SRLLSGVAYT	AFS--GPVDR	GHYTVYDTAK	KSMYDGDREY	KHDLSSLSVT	SVVMVGGYVA
PEDV	HLFLKGVSYT	TFLDNGNGVV	GHYTVFDHGT	GMVHDGDAEF	PGDLNVSPVT	NVVVSEQTAV
TGEV	-EVLEATGYI	CYS--GSNRN	GHYTYDNRN	GLVVDAEKAY	HFNRDOLLQVT	TAIASNFVVK
OV43	SVIVNDTSE	TRYVKSLSIV	DVYDMWLTGC	KYVVRTANAL	SRAVNVPTIR	KFIKFGMTLV
BoCoV	SVIVNDTSE	IKYVKSLSIV	DVYDMWLTGC	RCVVRTANAL	SRAVNVPTIR	KFIKFGMTLV
MHV	SVVNDPTSE	TKVVKLSIV	DVYDMWLTGC	RYVVMANAL	SRLVNSPTVR	EYVKKWGMTKI
AIBV	AIWVEGNANF	VVG-----	HP NYYSKSLHIP	TFWENAENFV	KMGDKIGGVT	MGLWRAEHLN
SARS CoV	NVILKPSDEG	VKVTQELGHE	DLMAAYVENT	SITIKKPNEL	SLALGLKTIA	THGIAAINS

	2225	2235	2245	2255	2265	2275
EMCR	S-----	-----NVPP	IVSEKISVMD	KLDTG---AQ	KFFQFGDFVM	NNIVLFLTWL
229E	-----	-----PV	NTVKPKPVIN	QLDEK---AQ	KFFDFGDFLI	HNFIFFFTWL
PEDV	V-----	-----IKDP	VKKAELDATK	LLDTMNYASE	RFFSFGDFMS	RNLITVFLYI
TGEV	KPQAEERPKN	CAFNKVAAAP	KIVQEQLLA	IESGANYALT	EFGRYADMFF	MAGDKILRL
OV43	SIP-----	-----IDLL	NLREIKPAVN	VVKAVRNKIS	VCNFNIKWLF	VLLFGWIKIS
BoCoV	SIP-----	-----IDLL	NLREIKPVFN	VVKAVRNKIS	ACNFNIKWLF	VLLFGWIKIS
MHV	VIP-----	-----AKLV	LLRDEKQEFV	APKVVKAKVI	ACYSVKKWFF	LYCFSWIKFN
AIBV	KPN-----	-----LERI	FNIAKKAIVG	SSVVTTCQCK	LIGKAATFIA	DKVGGGVVRN
SARS CoV	PWS-----	-----KILA	YVKPFLG---	--QAAITTSN	CAKRLAQRVF	NNYMPYVFTL

	2285	2295	2305	2315	2325	2335
EMCR	LSMFSLLRTS	IMKHDIKIVA	KAPKRTGVIL	TRSFYKNIRS	ALFVVQKQWC	VIVTLFKFLL
229E	LSMFTLCKTA	VTTGDVKIMA	KAPQRTGVVL	KRSLKYNLKA	SAAVLKSQWV	LLAKFTKLLL
PEDV	LSILGLCFRA	FRKRDVKVLA	GVPQRTGIIL	RKSMRYNAKA	LGVFVKLKL	WFKVLGKFSL
TGEV	LEVFKYLLVL	FMCLRSTKMP	KVKVKP-PLA	FKDFGAKVRT	LNVMRQLNKP	SVWRVAKLVL
OV43	ADNKVIYITE	IASKLTCKLV	ALAFKNAFLT	FKWSMVARGA	CIIATIFLLW	FNFIYANVIF
BoCoV	ADNKVIYITE	VASKLTCKLV	ALAFKNAFLT	FKWSMVARGA	CIIATIFLLW	FNFIYANVIF
MHV	TDNKVIYITE	VASKLTENLC	CLAFKNAFLT	FNWVVSRGF	FLVATVFLW	FNFIYANVIL
AIBV	ITDSIKGLCG	ITRGHFERKM	SPOFLKTLMF	FLFYFLKASV	KSVVASVYKT	LCKVVLATLL
SARS CoV	LFQLCTFTKS	TNSRIRASLP	TTIAKNSVKS	VAKLCLDAGI	NYVKSPPKFSK	LFTIAMWLLL

	2345	2355	2365	2375	2385	2395
EMCR	LLYAIYALVF	MIVQFSPFNS	LLCGDIVSGY	EKSTFN---	--KDIYCGNS	MVCKMCLFSY
229E	LIYTLYSVVL	LCVRFPGPFN	-FCSETVNGY	AKSNFV---	--KDDYCDGS	LGCKMCLFGY
PEDV	GIYALYALLF	MTIRFTPIGS	PVCDDVAGY	ANSSFD---	--KNEYCN-S	VICKVCLYGY
TGEV	LLIAIYNFFY	LFVSI PVVHK	LTCNGAVQAY	KNSSFI---	--KSAYCGNS	ILCKACLASY
OV43	SDFYLPKIGF	LPTFVGKIAQ	WIKNTFSLVT	ICDLYSMQDV	GFKNQYCNCS	IACQFCLAGF
BoCoV	SDFYLPKIGF	LPTFVGKIVQ	WIKNTFSLVT	ICDLYSIQDV	GFKNQYCNCS	IACQFCLAGF
MHV	SDFYLPNIGF	FPTFVGQIVA	WVKTTFGIFT	LCOLYQVSDV	GYRSSFCNCS	MVCELCFSGF
AIBV	IWVFVYTSNP	VMFTGIRVLD	FLFEGSLCGP	YKDYGK--DS	FDVLRVCADD	FICRVCLHDK
SARS CoV	LSICLGSLIC	VTAAGFVLLS	NFGAPSYCNG	VRELYLNSSN	VTTMDFCESG	FPCSICLSGL

	2405	2415	2425	2435	2445	2455
EMCR	QEFNOLDHTS	LWVKHIR---	-----D--P--	-ILISLQPFV	ILVILLIFGN	MYLRFGLLYF
229E	QELSQFSHLD	VWVKHIT---	-----D--P--	-LFSNMQPFV	VMVLLIFGD	NYLRCFLLYF
PEDV	QELSDFSHTQ	VWQHLR---	-----D--P--	-LIGNVMPFF	YLAFLAIFGG	VYVKAITLYF
TGEV	DELADFOHLQ	VTWDFKS---	-----D--P--	-LWNRLVQLS	YFAFLAVFGN	NYVRCFLMYF
OV43	DMLDNYKAID	VVQYEADRRR	FVDYTGVLKI	VIELIVSYAL	YTAWFYPLFA	LISIQILTTW
BoCoV	DMLDNYKAID	VVQYEADRRR	FVDYTGVLKI	VIELIVSYAL	YTAWFYPLFA	LISIQILTTW
MHV	DMLDNYDAIN	VVQHVVDORR	SFDYISLFKL	VVELIYIGSL	YTVCFYPLFG	LIGMQLTTW
AIBV	DSLHLYKHAY	SVEQVYKDA	SG-----	--FIFNWNWL	YLVFLILFVK	PVAGFVLIYC
SARS CoV	DSLDSYPAL	TIQVTIS--S	YKLDLTILGL	AAEWVLAJML	FTKFFYLLGL	SAIMQVFFGY

	2465	2475	2485	2495	2505	2515
EMCR	VAQFISTFG-	-SFLGFHQKQ	WFLHFVPFDV	LCNEFLATFI	VCKIVLFVRH	IIVGCNNADC
229E	VAQMISTVG-	-VELGYKETN	WFLHFIPFDV	ICDELLVTVI	VIRVISFVRH	VLFGCENPDC
PEDV	IFQYLNLSLG-	-VFLGLQOQSI	WFLQLVPFDV	FGDEIVVFFI	VTRVLMFIKH	VCLGCDKASC
TGEV	VSQYLNHLWL-	-SYFGYVEYS	WFLHVVNFES	ISAEFVIVVI	VVKAVLALKH	IVFACSNPSC
OV43	LPELFMLST-	-LHWSVRLLV	ALANMLPAHV	FMRFYIIIAS	FIKLFSLFRH	VAYGCSKSGC
BoCoV	LPELLMLST-	-LHWSVRLLV	SLANMLPAHV	FMRFYIIIAS	FIKLFSLFRH	VAYGCSKSGC
MHV	LPEFFMLET-	-MHWSARFFV	FVANMLPAFT	LLRFYIVVTA	MYKIFCLCRH	VMYGCSPGPG
AIBV	CVKYLVLNST	VLQTVGCFLD	WFVQTVFSHF	NFMGAGFYFW	LFYKIYIQVH	HILYCKDVTC
SARS CoV	FASHFISN--	--SWLMWFII	SIVQMAPVSA	MVRMYIFFAS	FYYIWKSYVH	IMDGCTSSTC

	2525	2535	2545	2555	2565	2575
EMCR	VACSKSARLK	RVPLQTIING	MHKSFYVNAN	GGTCFCNKHN	FFCVNCDSEF	PGNTFINGDI
229E	IACSKSARLK	RFPVNTIING	VQRSFYVNAN	GGSKFCCKHR	FFCVDCDSYG	YGSTFITPEV
PEDV	VACSKSARLK	RVPVQTIQOG	TSKSFYVHAN	GGSKFCCKHN	FFCLNCDSYG	PGCTFINDOI
TGEV	KTCSTARQT	RIPIQVNVNG	SMKTVYVHAN	GTGKFCCKHN	FYCKNCDSYG	FENTFICDEI
OV43	LFCYKRNRL	RVKCSTIVGG	MIRYDVMAN	GGTGFCCKHQ	WNCIDCDSYK	PGNTFITVEA
BoCoV	LFCYKRNRL	RVKCSTIVGG	MIRYDVMAN	GGTGFCCKHQ	WNCIDCDSYK	PGNTFITVEA
MHV	LFCYKRNRL	RVKCSTIVGG	TLRYDVMAN	GGTGFCCKHQ	WNCIDCDSYK	PGNTFITVEA
AIBV	EVCKRVARSN	RQEVSVVGG	RKQIVHVYTN	SGYNFCCKHN	WYCRNCDYD	HQNTFMSPEV
SARS CoV	MMCYKRNRL	RVECTIIVNG	MKRSFYVYAN	GGRGFCCKHN	WNCIDCDSYK	TGSTFISDEV

	2585	2595	2605	2615	2625	2635
EMCR	ARELGNVVK	AVQPTAPAYV	IIDKVDFVNG	FYRLYSGDTF	WRYDFDITES	KYSCKE----
229E	SRELGNITKT	NVQPTGPAYV	MIDKVEFENG	FYRLYSCETF	WRYNFDITES	KYSCKE----
PEDV	ATEVGNVVK	NVQPTGPATI	LIDKVEFSNG	FYRLYSGDTF	WRYNFDITES	KYSCKE----
TGEV	VRDLNSVVKQ	TVYATDRSHQ	EVTKVECSDG	FYRFYVGDDEF	TSYDYDVKHK	KYSCKE----
OV43	ALDLSKELKR	PIQPTDVAYH	TVTDDVKQVGC	SMRLFYDRDG	QRTYDDVNAS	LFVDYSNLLH
BoCoV	ALDLSKELKR	PIQPTDVAYH	TVTDDVKQVGC	SMRLFYDRDG	QRTYDDVNAS	LFVDYSNLLH
MHV	ADLDSKELKR	PVNPTDSAYY	LVTEVKQVGC	SMRLFYDRDG	QRTYDDVNAS	LFVDYSNLLH
AIBV	AGELSEKELKR	HVKPTAYAYH	VVDEACLVD	FVNLKYKAAT	PGKDSASSAV	KCFSVTDFLK
SARS CoV	ARDLSLQFKR	PINPTDQSSY	IVDSVAVKNG	ALHLYFDKAG	KQTYERHPLS	HFVNLNLR

	2645	2655	2665	2675	2685	2695
EMCR	-VLKNCNVLE	NFIVVNN---	-----SGSNI	TQIKNACVYF	SQLLCEPIKL	VNSELLSTLS
229E	-VFKNCNVLD	DFIVFNN---	-----NGTNV	TQVKNASVYF	SQLLCRPIKL	VNSELLSTLS
PEDV	-ALKNCSIIIT	DFIVFNN---	-----NGSNV	NQVKNACVYF	SQMLCKPVKL	VDSALLASLS
TGEV	-VLKSMMLLD	DFIVVSP---	-----SGSAL	ANVRNACVYF	SQILGKPIKI	VNSOLLEDS
OV43	SKVKSVPNMH	VVVVEN----	-----DADK	ANFLNAAVYF	AQSLFRPILM	VOKNLITTAN
BoCoV	SKVKSVPNMH	VVVVEN----	-----DADK	ANFLNAAVYF	AQSLFRPILM	VOKNLITTAN
MHV	SKVKGVPETH	VVVVEN----	-----EADK	AGFLNAAVYF	AQSLYRPMIL	VEKKLITTAN
AIBV	KAVFLKEALK	CEQISNDGFI	VCNTQSAHAL	EEAKNAAIYY	AQYLCKPILI	LDQALYEQLV
SARS CoV	NNTKGSLPIN	VIVFDGK---	-----SKCDE	SASKSASVYV	SQLMCQPILL	LDQVLVSDVG

	2705	2715	2725	2735	2745	2755
EMCR	--VDFNGVLH	KAYVDVLCNS	FFKELTANMS	MAECKATLGL	T-----	-----
229E	--VDFNGVLH	KAYIDVLRNS	FGKDLNANMS	LAECKRALGL	S-----	-----
PEDV	--VDFGASLH	SAFVSVLNS	FGKDLSSCND	MQDCKSTLGF	DD-----	-----
TGEV	--VDFKGALF	NAKKNVIKNS	FNVDSVECKN	LDECYRACNL	N-----	-----
OV43	TGTSVTTMTF	DVYVDTFLSM	FDVDDKSLNA	LIATAHSSIK	OGTOIYKVL	TFLSCARKSC
BoCoV	TGTSVTTMTF	DVYVDTFLSM	FDVDDKSLNA	LIATAHSSIK	OGTOICKVL	TFLSCARKSC
MHV	TGLSVSQTMTF	DLYVDSLLGV	LDVDRKSLTS	FVNAAHNSLK	EGVQLEQVMD	TFIGCARRKC
AIBV	V-EPVSKSVI	DKVCSILSSI	ISVDTAALNY	KAGTLRDALL	S-----	-----
SARS CoV	DSTEVSVMKF	DAYVDTFSAT	FSVPMELKKA	LVATAHSELA	KGVALDGVLS	TFVSAARQGG

	2765	2775	2785	2795	2805	2815
EMCR	-----VSDDD	FVSANVAHR	YDVLLSDLSF	NNFFISYAKP	EDK-LSVYDI	ACCMRAGSKV
229E	-----ISDHE	FTSAISNAHR	CDVLLSDLSF	NNFVSSYAKP	EEL-LSAYDL	ACCMRAGAKV
PEDV	-----VPLDT	FNAVAEAEHR	YDVLLTDMSE	NNFTTSYAKP	EEL-FPVHDI	ATCMRVGAKI
TGEV	-----VSFST	FEMAVNNAHR	EGILITDRSF	NNFWPSKVVP	GGSGVSAMDI	GKCMTSDAKI
OV43	SIDSVDVTKC	LADSVMSAVS	AGLELTDESC	NNLVPTYLKS	DN--IVAADL	GVLIQNSAKH
BoCoV	SIDSVDVTKC	LADSVMSAVS	AGLELTDESC	NNLVPTYLKG	DN--IVAADL	GVLIQNSAKH
MHV	AIDSVDVTKS	ITKSIMSAVN	AGVDFTDESC	NNLVPTYVKS	DT--IVAADL	GVLIQNSAKH
AIBV	-----ITKDEE	AVDMAIFCHN	HDVDYTGDF	TNVPISYDID	TG-KLTPRDR	GFLINADASI
SARS CoV	VVDVDVDTKD	VIECKLSHH	SDLEVTGDSC	NNFMLTYNKV	EN--MTPRDL	GACIDCNARH

	2825	2835	2845	2855	2865	2875
EMCR	VNHNVLKES	IPVWGVKDF	NLSQEGKKY	LVKTTAKAGL	TFLLTENDNQ	AITQVP----
229E	VNANVLTKDQ	TPVWVHAKDF	NLSAEGKKY	IVKTSKAKGL	TFLLTINENQ	AVTQIP----
PEDV	VNHNVLKDS	IPVWVLRDF	IALSEETRYK	IIRTTKVKGI	TFMLTFNDCR	MHTTIP----
TGEV	VNAKVLTRG	KSVVWLSQDF	AALSSTAQV	LVKTFVEGV	NFSLTFNAV	SDDLPLYERF
OV43	VQGNVAKIAG	VSCIWSVDAF	NQFSSDFQHK	LKKACCKTGL	KLKLTYNKQM	ANVSVL----
BoCoV	VQGNVAKIAG	VSCIWSVDAF	NQFSSDFQHK	LKKACCKTGL	KLKLTYNKQM	ANVSVL----
MHV	VQANVAKAAN	VACIWSVDAF	NQFSSDFQHK	LKKACCKTGL	KLKLTYNKQM	ANVSVL----
AIBV	ANLVRKN--A	PPVWVWFSEL	IKLSDSLCKY	LISATVRSKV	RFITKSGAK	QVIACHT----
SARS CoV	INAQVAKSHN	VSLIWNVVDY	MSLSEQLRQ	IRSAARKNNI	PFRLTCATTR	QVNVNIT----

	2885	2895	2905	2915	2925	2935
EMCR	ATSIIVAKQGA	G-----	--FKRTYNFL	WYVCLFVVAL	FIGVSFID--	---YTTTITS
229E	ATSIIVAKQGA	GD-----	--AGHSLTWL	WLLCGLVCLI	QFYLCFEMPY	--FMYDIVSS
PEDV	TVCIANKKGA	GLPS-----	--FSKVKKFF	WFLCLFIVAA	FFALSFLD--	---FSTQVSS
TGEV	TESVSPKSGS	G-----	--FFDVITQL	KQIVILVEVF	IFICGLCSVY	SVATQSYIES
OV43	--TPFSLKGG	A--V-----	--FSYFVYVC	FVLSLVCFIG	---LWCLMPT	YTVHKSDFQL
BoCoV	--TPFSLKGG	A--V-----	--FSYFVYVC	FVLSLVCFIG	---LWCLMPT	YTVHKSDFQL
MHV	--TPFSLKGG	A--V-----	--FSKVLQWL	FVNLICFIV	---LWALMPT	YAVHKSMDQL
AIBV	QKLLVEKKAG	GIVSGTFKCF	RSYFKWLLIF	YILFTACCSG	YYYMEVSKSF	VHPMYDVNST
SARS CoV	--TKISLKGG	K--I-----	--VSTCFKLM	LKATLLCVLA	ALVCYIUMPV	HTLSIHDGYT

	2945	2955	2965	2975	2985	2995
EMCR	FHGYDFRYIE	NGQLKVFEAP	LHCVRNVFDN	FNQWHEAKFG	VVTTNSDKCP	IVVG----VS
229E	FEGYDFRYIE	NGQLKNFEAP	LKCVNRNVFEN	FEDWHYAKFG	FTPLNKQSCP	IVVG----VS
PEDV	DSDDYFKYIE	SGQLKTFDNP	LSCVHNVFEN	FDQWHDARFG	FTPNNPNSCP	IVVG----VS
TGEV	AEGYDMYKVI	NGVIRQPFDDT	ISCVHNTYKG	FGDWFKAKYK	FIPTFGKSCP	IVVGT--VFDL
OV43	PVYASYKVL	NGVIRDVSV	DVCFANKFEQ	FDQWYESTFG	LSYYSNSMAC	PIVVA-VIDQ
BoCoV	PVYASYKVL	NGVIRDVSV	DVCFANKFEQ	FDQWYESTFG	LSYYSNSMAC	PIVVA-VVDQ
MHV	PLYASFVID	NGVLRDVTVT	DACFANKFIQ	FDQWYESTFG	LVYYRNSRAC	PVVVA-VIDQ
AIBV	LHVEGFKVID	KGVLREIVPE	DTCFSNKFVN	FDQWYESTFG	NSRNCPIVTA	VIDGDGTAT
SARS CoV	NEIIGYKAIQ	DGVTRDIIST	DDCFANKHAG	FDQWYESTFG	S--YKNDKSC	PVVAA-IITR

	3005	3015	3025	3035	3045	3055
EMCR	ERINVPVGPV	TNVYLVG---	-KTLVFTLQA	AFNGTGVGYD	FDGVTTS---	--DKCIFNSA
229E	EIVNTVAGIP	SNVYLVG---	-KTLIFTLQA	AFNGTGVGYD	IFGVTTT---	--EKCIFTSA
PEDV	DEARTVPGIP	AGVYLAG---	-KTLVFAINT	IFGTSGLCFD	ASGVADK---	--GACIFNSA
TGEV	ENMRPIPDVP	AYVSIVG---	-RSLVFAINA	AFGVTNMCYD	HTGNVSKDS	YFDTVCVNTA
OV43	DFGSTVFENP	TKVLRYG---	YHVLHFITHA	LSADGVQCYT	PHSQISYSNF	YASGCVLSSA
BoCoV	DFGSTVFENP	TKVLRYG---	YHVLHFITHA	LSADGVQCYT	PHSQISYSNF	YASGCVLSSA
MHV	DIGYTLFNP	TKVLRYG---	FHVLHFITHA	FATDSVQCYT	PHMQIPYDNF	YASGCVLSSL
AIBV	GVPGFVSWM	DGVMEIHMTQ	TERKWPYIPT	WFNRVIGYT	QDSIITEGSF	YTSIALFSAR
SARS CoV	EIGFIVPGLP	GTVLRAIN--	GDFLHFLPRV	FSAVGNICYT	PSKLEIYSDF	ATSACVLAAE

	3065	3075	3085	3095	3105	3115
EMCR	CTRLGGLGGD	-NVYCYNTDL	IEGSKPYISL	QPNAYYKYDV	K-NYVRFPEI	LARGFGLRTI
229E	CTRLGGLGGN	-NVYCYNTAL	MEGSLPYSSI	QANAYYKYDN	G-NFIKLPEI	IAQGFGLRTI
PEDV	CTTLGGLGGT	-AVYCYKNGL	VEGAKLYSEL	APHSYKMYD	G-NAVSLPEI	ISRGFGIRTI
TGEV	CTTLTGLGGT	-IVYCAKQGL	VEGAKLYSDL	MPDYIYEHAS	G-NMVKLPAI	IR-GLGLRFV
OV43	CTMTMADGS	PQPYCYTEGL	MQNASLYSSL	VPHVRYNLAN	AKGFIRFPEV	LREGL-VRIV
BoCoV	CTMFAMADGS	PQPYCYTDGL	MQNASLYSSL	VPHVRYNLAN	AKGFIRLPEV	LREGL-VRIV
MHV	CTMLAHADGT	PHPYCYTEGI	MNASLYDSSL	APHVRYNLAN	SNGYIRFPEV	VSEGI-VRIV
AIBV	CLYLTAINTP	QLYCFNGDND	APGALPFGSI	IPHRVYFQPN	GVRLIVPQOI	LHTPY---VV
SARS CoV	CTIFKDAMGK	PVPYCYDTNL	LEGSISYSEL	RPDTRYVLMD	G-SIIQFPNT	YLEGS-VRVV

	3125	3135	3145	3155	3165	3175
EMCR	RTLATRYCRV	GECRDSHKGV	CFGFDKXYVN	DGRVD---DG	YICGDGLIDL	LVNVLISFSS
229E	RTIATKYCRV	GECVESNAGV	CFGFDKWEVN	DGRVA---NG	YVCGTGLWNL	VFNILSMFSS
PEDV	RTKAMTYCRV	GQCVQSAEGV	CFGADRFFVY	NAESG---SD	FVCGTGLFTL	LMNVISVFSK
TGEV	KTQATTYCRV	GECIDSKAGF	CFGGDNWFVY	DNEFG---NG	YICGNSVLGF	FKNVFKLFNS
OV43	RTRMSYCRV	GLCEEADDEGI	CFNFNGSWVL	NNDYYSRLPG	TFCGRDVFOL	IYQLFKGLAQ
BoCoV	RTRMSYCRV	GLCEEADDEGI	CFNFNGSWVL	NNDYYSRLPG	TFCGRDVFOL	IYQLFKGLAQ
MHV	RTRMSYCRV	GLCEDAEDEGV	CFNFNSWVL	NNPYRRAMPG	TFCGRNADFOL	IHQVLGGLVR
AIBV	KFVSOSYCRG	SVCEYTRPGY	CVSLNPQWVL	FNDYTSKPG	VFCGSTVREL	MFSMVSTFTT
SARS CoV	TTFDAEYCRH	GTCERSEVGI	CLSTSGRWVL	NNEHYRALSG	VFCGVDMANL	IANTFTPLVQ

	3185	3195	3205	3215	3225	3235
EMCR	SFSVAMSGH	MLFNELFAAF	ITFLCFLVTK	FKRVFGDLSY	GVFTVVCATL	INNISYVVTO
229E	SFSVAMSGQ	ILLNCALGAF	AIFCCFLVTK	FRRMFGDLSV	GVCTVVAVL	LNNVSYIVTO
PEDV	TVPVTVLSGQ	ILFNCTIAFV	AVAVCFLETK	FKRMFGDMSV	GVFTVGACTL	LNNVSYIVTO
TGEV	NMSVVATSGA	MLVNIIIAEL	AIAMCYGVLK	FKKIFGDCFT	LIVMIIITLV	VNNVSYFVTO
OV43	PVDFALATAS	SIAGAILAVI	VVLVFFYLK	LKRAFGDYTS	VVFVNVIVWC	VNFMMLEVFQ
BoCoV	PVDFALATAS	SIAGAILAVI	VVLGFFYLK	LKRAFGDYTS	IVFVNVIVWC	VNFMMLEVFQ
MHV	PIDFFALATAS	SVAGAILAVI	VVLAFYLLK	LKRAFGDYTS	VVFVNVIVWC	VNFMMLEVFQ
AIBV	GVN-PNIYMQ	LATMFLILVV	VVLIFAMVIR	FQGVFKAYAT	TVFITHLVVW	INAFILCVHS
SARS CoV	PVGALDVSAS	VVAGGIIAIL	VTCAYYFEMK	FRRVFGEYNH	VVAANALLFL	MSFTILCLVP

	3245	3255	3265	3275	3285	3295
EMCR	N-LFFMLLYA	ILYFVFTRTV	R--YAWIWHI	AYIVAYFLLI	PWWLLTWFSF	AAFLELLPNV
229E	N-LVTMIAYA	ILYFFATRSI	R--YAWIWCA	AYLIAYISFA	PWWLCAWYFL	AMLTGLLPNL
PEDV	N-TLGLMGLA	TLYFLCTKGV	R--YMWIWHL	GFLISYILIA	PWWVLMVYAF	SAIFEFPNL
TGEV	N-TFFMIIYA	IVYYFITRKL	A--YPGILDA	GFLIAYINMA	PWYVITAYIL	VFLYDLSPLS
OV43	VYPTLSCVYA	ICYFYATLYF	PSEISVIMHL	QWLVMYGTIM	PLWFCLLYIA	VVVSNNHAFV
BoCoV	VYPTLSCVYA	ICYFYATLYF	PSEISVIMHL	QWLVMYGTIM	PLWFCLLYIS	VVVSNNHAFV
MHV	VYPTLSCVYA	CFYFYTTLYF	PSEISVIMHL	QWLVMYGAIM	PLWFCIIYVA	VVVSNNHALWL
AIBV	YNSVLAVILL	VLYCYASLVT	SRNTVIIMHC	WLVTFTGLIV	PTWLACCYLG	FIIYMYTPLF
SARS CoV	AYSFLPGVYS	VFYLYLTFYF	TNDVSFLAHL	QWFAMFSPIV	PFWITAIYVF	CISLKHCHWF

	3305	3315	3325	3335	3345	3355
EMCR	FKLKISTQ--	--LFEGDKFI	GTFFSAAAGT	FVLDMSRYER	LINT--ISPE	KLKNYAASYN
229E	LKLKVSTN--	--LFEGDKFV	GTFFSAAAGT	FVIDMRSYER	LANS--ISPE	KLKSYAASYN
PEDV	FKLKVSTQ--	--LFEGDKFV	GSFFSAAAGT	FVIDMHAYER	LANS--ISTE	KLRQYASTYN
TGEV	FKLKVSTN--	--LFEGDKFV	GNFFSAAAGT	FVIDMRSYET	IVNS--TSIA	RIKSYANSFN
OV43	FSYCRQLG--	--TSVR--SD	GTFFSAAAGT	FMITKDSYCK	LKNS--LSDV	AFNRYLSLYN
BoCoV	FSYCRQLG--	--TSVR--SD	GTFFSAAAGT	FMITKDSYCK	LKNS--LSDV	AFNRYLSLYN
MHV	FSYCRQLG--	--TSVR--SD	GTFFSAAAGT	FMITKDSYCK	LKNS--LSDV	AFNRYLSLYN
AIBV	LWCYGTNT	RKLYDGNFV	GNYDLAAKST	FVIRGSEFVK	LTNE---IGD	KFEAYLSAYA
SARS CoV	FNNYLRKR--	--VMFNGVTF	STFEAAALCT	FLNKMELYK	LRSETLLPLT	QYNRYLALYN

	3365	3375	3385	3395	3405	3415
EMCR	KYKYSGSAS	EADYRCACYA	HLAKAMLDYA	-KDHNMLYS	PPTISYN-ST	LQSGLKMAQ
229E	RYKYSGNAN	EADYRCACYA	YLAKAMLDYS	-RDHNDILYT	PPTVSYG-ST	LQAGLRKMAQ
PEDV	KYKYSGSAS	EADYRLACFA	HLAKAMMDYA	-SNHNDTLYT	PPTVSYN-ST	LQAGLRKMAQ
TGEV	KYKYTGSMG	EADYRMACYA	HLGKALMDYS	-VNRTDMLYT	PPTVSVN-ST	LQSGLRKMAQ
OV43	KYRYSGKMD	TAAYREAACS	QLAKAMDTFT	NNNGSDVLYQ	PPTASVSTSF	LQSGIVKMFV
BoCoV	KYRYSGKMD	TAAYREAACS	QLAKAMDTFT	NNNGSDVLYQ	PPTASVSTSF	LQSGIVKMFV
MHV	KYRYSGKMD	TAAYREAACS	QLAKAMDTFT	NNNGSDVLYQ	PPTASVSTSF	LQSGIVKMFV
AIBV	RLKYSGTGS	EQDYLQACRA	WLAYALDQYR	-NSGVEIYVT	PPRYSIGVSR	LQSGFKKLVF
SARS CoV	KYKYSGGALD	TTSYREAACC	HLAKALNDYS	-NSGADVLYQ	PPQTSITSATV	LQSGFKKMAF

	3425	3435	3445	3455	3465	3475
EMCR	PSGCVERCVV	RVCYGSTVLN	GVWLGDTVTC	PRHVIAPSTT	VL-IDYDHAY	STMRLHNFVS
229E	PSGFVEKCVV	RVCYGNVTLN	GLWLGDIYVC	PRHVIASNTT	SA-IDYDHEY	SIMRLHNFVS
PEDV	PSGVVEKCVV	RVCYGNMVLN	GLWLGDIYVC	PRHVIASSTT	ST-IDYDIAL	SVLRLHNFVS
TGEV	PSGLVEPCIV	RVSYGNNVLN	GLWLGDEVIC	PRHVIASDTT	RV-INYNEM	SSVRLHNFVS
OV43	PTSKVEPCIV	SVTYGNMTLN	GLWLDKVKYC	PRHVICSSAD	MTNPDYTNLL	CRVTSSTDTV
BoCoV	PTSKVEPCIV	SVTYGNMTLN	GLWLDKVKYC	PRHVICSSAD	MTNPDYTNLL	CRVTSSTDTV
MHV	PTSKVEPCIV	SVTYGNMTLN	GLWLDKVKYC	PRHVICSSAD	MTDPOYSNLL	CRVISSDFCV
AIBV	PSSAVEKCVV	SVSYRGNNLN	GLWLGDTIYC	PRHVLGKFSG	DQ---WNDVL	NLANNHEFEV
SARS CoV	PSGKVEGCMV	QVTCGTTLN	GLWLDOTVYC	PRHVICTAED	MLNPNYEDLL	IRKSNHSLFV

	3485	3495	3505	3515	3525	3535
EMCR	SHNG-VFLGV	VGVTMHGSVL	RIKVSQSNVH	TPKHVFKTLK	PGASFNILAC	YEGIASGVFG
229E	ISGT-AFLGV	VGATMHGVTL	KIKVSQTNMH	TPRHSFRTLK	SGEGFNILAC	YDCAQGVFG
PEDV	SSGN-VFLGV	VSATMRGALL	QIKVNQNNVH	TPKYTYRTVR	PGESFNILAC	YDCAAGVYV
TGEV	SKNN-VFLGV	VSARYKGVNL	VLKVNQNNPN	TPEHKFSIK	AGESFNILAC	YEGCPGVSFG
OV43	LFDR-LSLTV	MSYQMRGCM	VLTVTLQNSR	TPKYTFGVVK	PGETFTVLAA	YNGKPGQAFH
BoCoV	LFDR-LSLTV	MSYQMRGCM	VLTVTLQNSR	TPKYTFGVVK	PGETFTVLAA	YNGKPGQAFH
MHV	MSGR-MSLTV	MSYQMQGSL	VLTVTLQNP	TPKYSFGVVK	PGETFTVLAA	YNGKSQGAH
AIBV	TTQHGVTLN	VSRLKGAFL	ILQTAVANAE	TPKYKFIKAN	CGDSFTIACA	YGGTVVGLYP
SARS CoV	QAGN-VQLRV	IGHSMQNCLL	RLKVDTSNPK	TPKYKFVRIQ	PGQTFSVLAC	YNGSPSGVYQ

	3545	3555	3565	3575	3585	3595
EMCR	VNLRTNFTIK	GSFINGACGS	PGYNVRNDGT	VEFCYLHQIE	LGSAGHVGSD	FTGSVYGNFD
229E	VNMRTNWTIR	GSFINGACGS	PGYNLKN-GE	VEFVYMHQIE	LGSAGHVGSD	FDGVMYGGFE
PEDV	VNMRSNYTIR	GSFINGACGS	PGYNINN-GT	VEFCYLHQIE	LGSAGHVGSD	LDGVMYGGFE
TGEV	VNMRSQGTIK	GSFIAGTCGS	VGYYLEN-GI	LYFVYMHQIE	LGNAGHVGSD	FEFEGYGGFE
OV43	VTMRSSTYIK	GSFLCGSCGS	VGYYVIMG-DC	VKEFVYMHQIE	LSTGCHTGT	FNGDFYGPYK
BoCoV	VTMRSSTYIK	GSFLCGSCGS	VGYYVIMG-DC	VKEFVYMHQIE	LSTGCHTGT	FNGDFYGPYK
MHV	VTMRSSTYIK	GSFLCGSCGS	VGYYVIMG-DC	VKEFVYMHQIE	LSTGCHTGT	FSGNFGPYR
AIBV	VTMRSNGTIR	ASFLAGACGS	VGFNIEK-GV	VNFFVYMHQIE	LPNALHTGT	LMGEFYGGYV
SARS CoV	CAMRNHTIK	GSFLNGSCGS	VGFNIDY-DC	VSEFCYMHQIE	LPTGVHAGTD	LEGKFYGPYV

	3605	3615	3625	3635	3645	3655
EMCR	DQPSLQVESA	NMLSDNVVA	FLYAALLNGC	R-----WWL	RSTRVNVDFG	NEWAMANGYT
229E	DQPNLQVESA	NQMLTVNVVA	FLYAAILNGC	T-----WWL	KGEKLFVEHY	NEWAQANGFT
PEDV	DQPTLQVEGA	SSLFTENVLA	FLYAALINGS	T-----WWL	SSSRIAVDRF	NEWAVHNGMT
TGEV	DQPSMQLEGT	NVMSSDNVVA	FLYAALINGE	R-----WVW	TNTSMSLESY	NTWAKTNSFT
OV43	DAQVQLLIQ	DYIQSVNFVA	WLYAAILNNC	N-----WVW	QSDKCSVEFD	NVWALSNGFS
BoCoV	DAQVQLPVQ	DYIQSVNFVA	WLYAAILNNC	N-----WVW	QSDKCSVEFD	NVWALSNGFS
MHV	DAQVQLPVQ	DYIQSVNFVA	WLYAAILNRC	N-----WVW	QSDKCSLEEF	NVWAMTNGFS
AIBV	DEEVAQRVPP	DNLVTNNIVA	WLYAAILSVK	ESSFSLPKWL	ESTTVSVDDY	NKWAGDNGFT
SARS CoV	DRQTAQAAGT	DTTITLNVLA	WLYAAVINGD	R-----WFL	NRFTTTLNDF	NLVAMKYNYE

	3665	3675	3685	3695	3705	3715
EMCR	IVSSVECC--Y	SILAARTGVS	VEQLLASIQH	LHE-GFGGKN	ILGYSSLCDE	FTLAEEVVKQM
229E	AMNGEDA--F	SILAARTGVC	VERLLHAIQV	LNN-GFGGKQ	ILGYSSLNDE	FSINEVVKQM
PEDV	TGVNTDC--F	SILAARTGVD	VORLLASIQS	LHK-NFGGKQ	ILGHTSLTDE	FTTGEVVRQM
TGEV	ELSSDA--F	SMLAARTGQS	VEKLLDSIVR	LNK-GFGGRT	ILSYGSLCDE	FTPTTEVIRQM
OV43	QVKSDELV--I	DALASMTGVS	LETLLAAIKR	LKN-GFQGRQ	IMGSCSFEDF	LTPSDVYQQL
BoCoV	QVKSDELV--I	DALASMTGVS	LETLLAAIKR	LKN-GFQGRQ	IMGSCSFEDF	LTPSDVYQQL
MHV	SIKADLV--L	DALASMTGVT	VEQILAAIKR	LYS-GFQGRQ	ILGSCVLEDE	LTPSDVYQQL
AIBV	PFSTSTA--I	TKLSAITGVD	VCKLLRTIMV	KNS-QWGGDP	ILGQYNFEDE	LTPSESVFNQI
SARS CoV	PLTQHDVHIL	GPLSAGTGIA	VLDMAALKE	LLQNGMNGRT	ILGSTHLEDE	FTPPFDVVRQC

	3725 3735 3745 3755 3765 3775
EMCR	YGVNLQS--- GKVIFGLRTM FLFSVFFTMF WAELFIYNT INWNPVILTP IFCLLLFLSL
229E	FGVNLQS--- GKTSMFKSI SLFAGFFVMF WAELFVYTTT INWNPGLTTP FMILLVALSL
PEDV	YGVNLQG--- GYVSRACRNV LLVGSFLTFF WSELVSYTKF FWVNPQYVTP MFACLSLLSS
TGEV	YGVNLQA--- GKVKSFFYP MTAMTILFAF WLEFFMYTPF TWINPTFVSI VLAVTTLIST
OV43	AGIRLQSKRT RLKFGTVCWI MASTFLFSCI ITAFVKWTF MYVTNNMFS- ITFCALCVIS
BoCoV	AGIRLQSKRT RLKVGIVCWI MASTFLFSCI ITAFVKWTF MYVTNNMFS- ITFCALCVIS
MHV	AGVKLQSKRT RVVKGTCWI LASTLLFCSI ISAFVKWTF MYVTTHMLG- VTLCALCFVS
AIBV	GGVRLQS--- -SFVRKATSW FWSRCVLACF LFVLCALVF TAVPLKFYVY AAVILLMAVL
SARS CoV	SGVTFQGFK KIVKGTHWM LLTFLTSLLI LVQSTQWSLF FFVYENAFLP FTLGIMAIAA

	3785 3795 3805 3815 3825 3835
EMCR	VLTMLFKHKF LFLQVFLPT VIATALYN-- --CVLDYYIV KFLADHEN-Y NVSVLQMDVQ
229E	CLTFVVKHKV LFLQVFLPS IIVAAIQ-- --CAWDYHVT KVLAEKFD-Y NVSVNQMDIQ
PEDV	LLMTTLKHKT LFFQVFLIPA LIVTSCIN-- --LAFDVEVY NYLAEHFD-Y HVSIMGFNAQ
TGEV	VFVSGIKHKM LFFMSFVLS VILVTAHN-- --LFWDFSYY ESLQSIVENT NTMLFVPMDQ
OV43	LAMLLVKKHK LYLTMYPV LFTLLYNNY- -LVVKHTFR GYVYAWLSY VPSVEYTYTD
BoCoV	LAMLLVKKHK LYLTMYPV LFTLLYNNY- -LVVKHTFR GYVYAWLSY VPSVEYTYTD
MHV	FAMLLVKKHK LYLTMFIMPV LCTLFYTN- -LVVKQSFRL GLAYAWLSH FPAVDYTYMD
AIBV	FISFTVKHVM AYMDTFLPT LITVIIGVCA EVPFYNTLI SQVVFISQW YDPVVFDTMV
SARS CoV	CAMLLVKKHK AFLCLFLPS LATVAYFN-- -MVMPASWV MRIMTWLELA DTSLSGYRLK

	3845 3855 3865 3875 3885 3895
EMCR	GLVNVLCFL VVFLH---TW RFSKERFTHW FTYVCSLIAV ATYTFYSGD- -----F
229E	GFVNIFICLF VALLH---TW RFAKERCTHW CTYLFSLIAV LYTALYSYD- -----Y
PEDV	GLVNIFFCFV VTILHGYTW RFFN-TPASS VTYVVALTA AYNFYASD- -----I
TGEV	GVMLTVFCFI VFVTVSVRFF TCKQSWFLA VTTILVIFNM VKIFGTSDEP WTENQIAFCF
OV43	EVIYGMILLV GMVFTLRSI NHDLSFIMF VGRISVFSL WYKGSNLEEE -----I
BoCoV	EVIYGMILLV GMVFTLRSI NHDLSFIMF VGRISVFSL WYKGSNLEEE -----I
MHV	EVLXGVLLV AMVFTMRSI NHDVFSVMFL VGRISVFSM WYFGANLEEE -----V
AIBV	PWMLPLVLY TAFKCVQGCY MNSFNTSLM LYQFVKLGFV IYTSNTTLTA YTEGNWELFF
SARS CoV	DCVMYASALV LLILMTARTV YDAAARRVWT LMNVITLVYK VYGNALDQA -----I

	3905 3915 3925 3935 3945 3955
EMCR	LSLLVMFLCA ISSDWYIGAI VFRLSRLIIF FSPE--SVFS VFQDVKLTIV VYLICGYLVC
229E	VSLVMFLCA ISNEWYIGAI IFRICRFGVA FLPV--EYVS YFDGVKTLLV FYMLLGFVSC
PEDV	LSCAMTFAS VTGNVFGAV CYKVAVMAL RFP---TFVA IFGDIKSMF CYLVGYFTC
TGEV	VNMLTMTVSL TTKDWMVIA SYRIAYIIVV CVMP-SAFVS DFGFMKCSI VYMACGYLFC
OV43	LLMLASLFGT YTWT---TVL SMAVARVIAK WVAVNVLYFT DIPQIKIVLL CYLFIGYIIS
BoCoV	LLMLASLFGT YTWT---TAL SMAARVIAK WVAVNVLYFT DIPQIKIVLV CYLFIGYIIS
MHV	LLFLTSLFGT YTWT---TML SLATAKVIK WLAVNVLYFT DVPQVKLVLL SYLCIGYVCC
AIBV	ELVHTTVLAN VSSNSLIGLF VFCAKWMY YCN-----AT YLNNYVLMV MNCIGWLCT
SARS CoV	SMWALVISVT SNYSGVVTI MFLARAIVFV CVEYPLLF I TGNTLQCIML VYCLFGYCCC

	3965 3975 3985 3995 4005 4015
EMCR	TYWGILYWFN RFFKCTMGVY DFKVSAAEFK YMVANGLHAP YGPFDAWLVS FKLLGIGGDR
229E	MYGILLYWIN RFFKCTLGIV DFCVSPAEEK YMVANGLNAP NGPFDALFLS FKLMGIGGPR
PEDV	CFYGILYWFN RFFKVSQGVY DYTVAEEFK YMVANGLRAP TGTLDLSLLS AKLIGIGGER
TGEV	CYYGILYWFN RFTCMTCGVY QFTVSAALK YMTANNLSAP KNAYDAMIS AKLIGVGGKR
OV43	CYWGFLSLMN SLFRMPLGVY NYKISVQELR YMNANGLRPP KNSFEALMLN FKLLGIGGVP
BoCoV	CYWGFLSLMN SLFRMPLGVY NYKISVQELR YMNANGLRPP KNSFEALMLN FKLLGIGGVP
MHV	CYWGVLSSLN SLFRMPLGVY NYKISVQELR YMNANGLRPP RNSFEALVLN FKLLGIGGVP
AIBV	CYFGLYWWVN KVFGTLGKY NFKVSVQYR YMLCHKINPP KTVWEVFTSN ILIQGIGGDR
SARS CoV	CYFGLFCLLN RYFRLTLGVY DYLVSTQEFR YMNSQGLLP KSSIDAFKLN IKLLGIGGKP

	4025 4035 4045 4055 4065 4075
EMCR	CIKISTVQSK LTDLKCTNVV LLGCLSSMNI AANSSEWAYC VDLHNKINLC DDPEKAQGM
229E	TIKVSTVQSK LTDLKCTNVV LMGILSSMNI ASNSKEWAYC VEMHNKINLC DDPETAQELL
PEDV	NIKISSVQSK LTDIKCTNVV LLGCLSSMNV SANSTEWAYC VDLHNKINLC NDPEKAQEM
TGEV	NIKISTVQSK LTEMKCTNVV LLGCLSKMHV ESNSKEWNYC VGLHNEINLC DDPEIVLEKL
OV43	IIEVSQFSK LTDVKCANV LLNCLQHLHV ASNSKLWHYC STLHNEILAT SDLSVAFEKL
BoCoV	IIEVSQFSK LTDVKCANG LLNCLQHLHV ASNSKLWQYC STLHNEILAT SDLGVAFEKL
MHV	VIEWSQISR LTDVKCNV LLNCLQHLHI ASSSKLWQYC STLHNEILAT SDLSVAFDKL
AIBV	VLPATVQAK LSDVKCTTV LMQLLTKLV EANSKMVYL VELHNKILAS DDVGECDNL
SARS CoV	CIKVATVQSK MSDVKCTSVV LLSVLQQLRV ESSSKLWQAC VQLHNDILLA KDTTEAFKEM

	4085 4095 4105 4115 4125 4135
EMCR	LALLAFLSK HSDFG-----LDGLIDSYF DNSSTLQSV SSVSMPSYI AYENARQAYE
229E	LALLAFLSK HSDFG-----LDGLVDSYF ENDSILQSV SSVFGMPSYV AYETARQAYE
PEDV	LALLAFLSK NSAFG-----LDDLLESYF NDNSMLQSV STYVGLPSYV IYENARQAYE
TGEV	LALLAFLSK HNTCD-----LSELIESYF ENTILQSV SAYAALPSWI ALEKARADLE
OV43	AQLLIVLFAN PAAVDSKCLT SIEEVCDY KONTVLQALQ SEFVNMAFV EYEVAKKNLD
BoCoV	AQLLIVLFAN PAAVDSKCLT SIEEVCDY KONTVLQALQ SEFVNMAFV EYEVAKKNLD
MHV	AQLLIVLFAN PAAVDSKCLT SIEEVSDYV ROSTVLQALQ SEFVNMAFV EYELAKKNLD
AIBV	LGMILTLFCI DSTID-----LSEYCDIL KRSTVLQSV QEFSHIPSYA EYERAKNLYE
SARS CoV	VSLLSVLLSM QGAVD-----INRLCEML DNRATLQAI SSSSLPSYA AYATAQEAYE

	4145 4155 4165 4175 4185 4195
EMCR	DAIANGSS-- --SOLIKQLK RAMNIAKSEF DHEISVQKKI NRMAEQAAQ MYKEARSVNR
229E	NAVANGSS-- --PQIIKQLK KAMNVAKEF DRESSVQKKI NRMAEQAAA MYKEARAVNR
PEDV	DAVNGSP-- --PQLVKQLR HAMNVAKEF DREASTQRKL DRMAEQAAAQ MYKEARAVNR
TGEV	EAKKNDVS-- --PQILKQLT KAFNIAKSD FEREASVQKKL DKMAEQAAAS MYKEARAVDR
OV43	EARFSGSAN-- --QQQLKQLE KACNIAKSAY ERDRAVAKKL ERMADLALTN MYKEARINDK
BoCoV	EACSSGSAN-- --QQQLKQLE KACNIAKSAY ERDRAVAKKL ERMADLALTN MYKEARINDK
MHV	EAKASGSAN-- --QQQIKQLE KACNIAKSAY ERDRAVAKKL ERMADLALTN MYKEARINDK
AIBV	KVLVDSKNGG VTQQLAAYR KAANIAKSVF DRDLAVQKKL DSMAERAMTT MYKEARVTDK
SARS CoV	QAVANGDS-- --EVVLKLLK KSLNVAKSEF DRDAAMQRKL EKMAEQAMTQ MYKQARSEDK

	4205 4215 4225 4235 4245 4255
EMCR	KSKVISAMHS LLFGMLRRLD MSSVETVLNL ARDGVVPLSV IPATSASKLT IVSPDLESYS
229E	KSKVVSAMHS LLFGMLRRLD MSSVDTILNM ARNGVVPLSV IPATSARLV VVVPDHSFV
PEDV	KSKVVSAMHS LLFGMLRRLD MSSVDTILNL AKDGVVPLSV IPAVSATKLN IVTSDISYN
TGEV	KSKVVSAMHS LLFGMLRRLD MSSVNTIIDQ ARNGVPLSI IPASATRLV VITPSLEVES
OV43	KSKVVSALQT MLFSMVRKLD NQALNSILDN AVKGCVPPLNA IPSLAANTLN IIVPDKSVYD
BoCoV	KSKVVSALQT MLFSMVRKLD NQALNSILDN AVKGCVPPLNA IPSLAANTLT IIVPDKSVYD
MHV	KSKVVSALQT MLFSMVRKLD NQALNSILDN AVKGCVPPLNA IPSLTSNTLT IIVPDKQVFD
AIBV	RAKLVSSLHA LLFSMLKKID SEKLVNLFDO ASSGVVPLAT VPIVCSNKLTV IIVPDPETWV
SARS CoV	RAKVTSAMQT MLFTMLRRLD NDALNNIINN ARDGCVPPLNI IPLTTAAKLM VVVPDYGTIK

	4265 4275 4285 4295 4305 4315
EMCR	KIVCDGSVHY AGVWVTLNDV KONDGRPVHV KEITRENVET LT-----WPL ILNCERVVK-
229E	KMMVDGFEVHY AGVWVTLQEV KONDGKVVHL KDVTENQEI LV-----WPL ILTCERVVK-
PEDV	RIQREGCVHY AGTIWNIIDI KONDGKVVHV KEVTAQNAES LS-----WPL VLGCERIVK-
TGEV	KIRQENNVHY AGAIWNIIVEV KDANGSHVHL KEVTAANELN LT-----WPL SITCERITK-
OV43	QVVDNVYVYTY AGNVWQIQTI QDSGDTNKQL NEISDDCN-- -----WPL VIIANRYNE-
BoCoV	QVVDNVYVYTY AGNVWQIQTI QDSGDTNKQL NEISDDCN-- -----WPL VIIANRNE-
MHV	QVVDNVYVYTY AGNVWQIQSI QDADGAVKQL NEIDVNIT-- -----WPL VIAANRNE-
AIBV	KCEGVGHVYTY STVVWNIDTV IDADGTELHP TSTGSGLTIC ISGANIAWPL KVNLTNRGNH
SARS CoV	NTCDGNTFTY ASALWEIQVQ VDADSKIVQL SEINMONSPN LA-----WPL IVTALRAN--

	4325 4335 4345 4355 4365 4375
EMCR	----LQ-NNE IMPGKLKQKP MKAEG--DGG VLDGDNALYN TEGGKTFMYA YISNKADLKF
229E	----LQ-NNE IMPGKMKVKA TRGEG--DGG ITSEGNALYN NEGGRAFMYA YVTTKPGMKY
PEDV	----LQ-NNE IIPGKLKQRS IKAEG--DG- IVGEGKALYN NEGGRTFMYA FISDRPDLRV
TGEV	----LQ-NNE IMPGKLKERA VRASATLDGE AFGSGKALMA SESGKSFMYA FIASDNNLKY
OV43	VSATVLQNE LMPAKLKIQV VNSGPDQTCN TPT--QCYYN NSNNGKIVYA ILSDVDGLKY
BoCoV	VSATVLQNE LMPAKLKIQV VNSGPDQTCN TPT--QCYYN NSYNGKIVYA ILSDVDGLKY
MHV	VSSVVLQNE LMPQKLRTQV VNSGSDMNCN TPT--QCYYN TTGMGKIVYA ILSDCDGLKY
AIBV	KVDVVLQNE LMPHGVKTKA CVAGVDQAHK SVES-KCYT NISGNSVVAI ITSSNPPLKV
SARS CoV	-SAVKLQNE LSPVALRQMS CAAGTTQTAC TDDNALAYYN NSKGGREVLIA LLSHDQDLKW

	4385 4395 4405 4415 4425 4435
EMCR	VKWEYEGG-- CNTIELDSPC RFMVETPNPQ QVKYLYFVKV LNTLRRGAVL GFIGATIRLQ
229E	VKWEHDSG-- VVTVELEPPC REVIDTPTGP QIKYLYFVKV LNNLRRGAVL GYIGATVRLQ
PEDV	VKWEFDGG-- CNTIELEPPC KFLVDSPNGA QIKYLYFVKV LNTLRRGAVL GYIGATVRLQ
TGEV	VKWEFNND-- IPIELEAPL RFYVDGANGP EVKYLYFVKV LNTLRRGAVL GYIGATVRLQ
OV43	TKILKDDGN- FVLELDPPC KFTVQDAKGL KIKYLYFVKV CNTLARGVWV GTISSTVRLQ
BoCoV	TKILKDDGN- FVLELDPPC KFTVQDVKGL KIKYLYFVKV CNTLARGVWV GTISSTVRLQ
MHV	TKIVKEDGN- CVLELDPPC KFSVQDVKGL KIKYLYFVKV CNTLARGVWV GTLSSTVRLQ
AIBV	ASFINEAGN- QIYVDLPPC KFGMKVGVK EVVYLYFIK TRSIVRGMVL GAISNVVVLQ
SARS CoV	ARFPKSDGTG TIYTELEPPC RFVTDTPKGP KVKYLYFIK LNNLNRGMVL GSLAATVRLQ

	4445 4455 4465 4475 4485 4495
EMCR	AG-KQTElav NSGLLTACAF SVDPAATYLE AVKHGAKPVS NCIMLSNGA GNGQAITTSV
229E	AG-KQTEFVS NSHLLTHCSF AVDPAAAYLD AVKQAKPVG NCVKMLTNGS GSGQAITCTI
PEDV	AG-KQTEQAI NSSLLTLCAF AVDPKATYID AVKSGHKPVG NCVKMLANGS GNGQAVTNGV
TGEV	AG-KPTEHPS NSSLLTLCAF SPDPKAYVD AVKRGMQPVN NCVKMLSNGA GNGMAVTNGV
OV43	AG-TATEYAS NSSILSLCAF SVDPKKTYLD FIQOQGTPIA NCVKMLCDHA GTGMAITVKP
BoCoV	AG-TATEYAS NSSILSLCAF SVDPKKTYLD FIQOQGTPIA NCVKMLCDHA GTGMAITVKP
MHV	AG-TATEYAS NSAIRSLCAF SVDPKKTYLD YIQOQGPVT NCVKMLCDHA GTGMAITIKP
AIBV	SKGHETEVD AVGILSLCSF AVDPADTYCK YVAAAGNQLG NCVKMLTVHN GSGFAITSKP
SARS CoV	AG-NATEVPA NSTVLSFCF AVDPKAYKD YLASGGQPT NCVKMLCTHT GTGQAITVTP

	4505 4515 4525 4535 4545 4555
EMCR	DANTNQDSYG GASICLYCRA HVPHP----S MDGYCKFKRG CVQVP-IGCL DPIRFCLENN
229E	DSNTTQDTYG GASVCIYCRA HVAHP----T MDGFCQYKRG WVQVP-IGTN DPIRFCLENT
PEDV	EASTNQDSYG GASVCLYCRA HVEHP----S MDGFCRLKRG YVQVP-LGTV DPIRFVLEND
TGEV	EANTQDQSYG GASVCIYCRC HVEHP----A IDGLCRYKRG FVQIP-TGTQ DPIRFCLENE
OV43	DATTSQDSYG GASVCIYCRA RVEHP----D VDGLCKLRGK FVQVP-VGIK DPVSYVLTHD
BoCoV	DATTSQDSYG GASVCIYCRA RVEHP----D VDGLCKLRGK FVQVP-VGIK DPVSYVLTHD
MHV	EATTNQDSYG GASVCIYCRS RVEHP----D VDGLCKLRGK FVQVP-LGK DPVSYVLTHD
AIBV	SPTPDQDSYG GASVCLYCRA HIAHPGSGVN LDGRQCQFSG FVQIP-TTEK DPVGFCLRNK
SARS CoV	EANMDQESFG GASCCLYCRC HIDHP----N PRGFCDLKGK YVQIPPTCAN DPVGFCLRNT

	4565	4575	4585	4595	4605	4615
EMCR	VCNVCGCWL	HGCACDRTTI	QSVDIS----	YLNRRAGSSA	-ARLEPCN-G	TDIDKCVRAF
229E	VCKVCGCWL	HGCTCDRTAI	QSFDNS----	YLNRRVGGSSA	-ARLEPCN-G	TDIDYCVRAF
PEDV	VCKVCGCWL	NGCTCDRSIM	QSTDYG----	LFKRVRGSSA	-ARLEPCN-G	TDQHVYRAF
TGEV	VCVVCWCWL	NGCMCDRTSM	QSFTVDQSY-	LFKRVRGSSA	-ARLEPCN-G	TDPDHVSRAF
OV43	VCRVCGFWRD	GSCSCVSTDT	TVQSKDTN--	FFKRVRGTSV	DARLVPCASG	LSTDVQLRAF
BoCoV	VCQVCGFWRD	GSCSCVSTDT	TVQSKDT--	FFKRVRGTSV	DARLVPCASG	LSTDVQLRAF
MHV	VCQVCGFWRD	GMFLCR-HRL	PVSVKRHE--	LFKRVRGTSV	NARLVPCASG	LSTDVQLRAF
AIBV	VCTVCCQWIG	YGCQCDLSRQ	PKSSVQS----	----VAGASD	FDKNYLN--	YGVAVRLGMF
SARS CoV	VCTVCCMWKG	YGCSCDQLRE	PLMQSADAST	FLNRVCGVSA	-ARLTFCGTG	TSTDVYVRAF
	4625	4635	4645	4655	4665	4675
EMCR	DIYNKNVSFL	GKCLKMNCVR	FKNADLK---	-DGYFVIKRC	TKSVMEHEQS	MYNLLNFSGA
229E	DVYNKDASFI	GKNLKSNCVR	FKNVOKD---	-DAFYIVKRC	IKSVMDHEQS	MYNLLKGCA
PEDV	DIYNKDVACL	GKFLKVNCR	LKNLQKH---	-DAFYVVKRC	TKSAMEHEQS	IYSRLKECGA
TGEV	DIYNKDVACI	GKFLKTNCNR	FRNLQKH---	-DAYYIVKRC	TKTVMDHEQV	CYNDLKDSGA
OV43	DIYNASVAGI	GLHLKVNCCR	FORVDENGDK	LQDFVVKRT	DLTIYNREMK	CYERVKDCKF
BoCoV	DICNASVAGI	GLHLKVNCCR	FORVDENGDK	LQDFVVKRT	DLTIYNREME	CYERVKDCKF
MHV	DICNANRAGI	GLYKVNCCR	FORADEGNT	LQDFVVKRT	NLEVYNKEKE	CYELTKECGV
AIBV	QNLKRNCRAR	QELRDTEDGN	LEYLDS----	----YFVVKQT	TPSNYEHEKS	CYEDLKS-EV
SARS CoV	DIYNKXVAGF	AKFLKTNCCR	FQEKDEEGNL	LDSYFVVKRH	TMSNYQHEET	IYNLVKDCPA
	4685	4695	4705	4715	4725	4735
EMCR	LAEHDFFTWK	DGRVIYGNVS	RHNLKRYTMM	DLVYAMRNFD	EQNCDVLKEV	LVLTGCCDNS
229E	VAKHDFFTWK	EGRTIYGNVS	RQDLTKRYTMM	DLCFALRNFD	EKDCVEFKEI	LVLTGCCSTD
PEDV	IAEHDFFTWK	DGRAIYGNVC	RKDLTEYTMM	DLCYALRNFD	ENNCVDLRSI	LKIVGACEES
TGEV	VAEHDFFTYK	EGRCFEGNVA	RRNLTKYTMM	DLCYAIRNFD	EKNCEVLKEI	LVTVGACTEE
OV43	VAEHDFFTFD	VEGSRVPHIV	RKDLTKYTMM	DLCYALRNFD	RNDCMLLCDI	LSIYAGCEQS
BoCoV	VAEHDFFTFD	VEGSRVPHIV	RKDLTKYTMM	DLCYALRNFD	RNDCMLLCDI	LSIYAGCEQS
MHV	VAEHDFFTFD	VEGSRVPHIV	RKDLTKYTMM	DLCYALRNFD	RNDCSTLKEI	LLTYACEDES
AIBV	TADHDFFTFN	KN---IYNIS	RQRLTKYTMM	DFCYALRNFD	PKDCEVLKEI	LVTYGCIEDY
SARS CoV	VAVHDFFTFR	VDGDMVPHIS	RQRLTKYTMM	DLVYALRNFD	EGNCDTLKEI	LVTYNCCDD
	4745	4755	4765	4775	4785	4795
EMCR	----YFDSKG	WYDPVENEDI	HRVYASLGKI	VARAMLKCA	LCDAMVAKGV	VGVLTLDNQD
229E	----YFEMKN	WFDPIENEDI	HRVYALGRV	VANAMLKCA	FCDEMVLKGV	VGVLTLDNQD
PEDV	----YFNKVK	WFDPIENEDI	HRVYALLGTI	VARAMLKCA	FCDAIVEKGY	IGVITLDNQD
TGEV	----YFENKD	WFDPIENEDI	HEVYAKLGPI	VANAMLKCA	FCDAIVEKGY	IGVITLDNQD
OV43	----YFTKKD	WYDFVENPDI	INVYKLGPI	FNRLVLSATE	FADKLVEVGL	VGVLTLDNQD
BoCoV	----YFTKKD	WYDFVENPDI	INVYKLGPI	FNRLVLSATE	FADKLVEVGL	VGVLTLDNQD
MHV	----YFQKKD	WYDFVENSDI	INVYKLGPI	FNRLVLSATE	FADKLVEVGL	VGVLTLDNQD
AIBV	HPKWFEENKD	WYDFVENSKY	YVMLAKMGPI	VRALLNAIE	FGNLMVEKGY	VGVLTLDNQD
SARS CoV	----YFNKKD	WYDFVENPDI	LRVYANLGER	VRQSLKTVQ	FCDAIRVAGI	VGVLTLDNQD
	4805	4815	4825	4835	4845	4855
EMCR	LNGNFYDFGD	FVSLPNMGV	PCCTSYYSYM	MPIMGLTNCL	ASECFVKS	FGSDFKTFDL
229E	LNGNFYDFGD	FVSLPNMGV	PCCTSYYSYM	MPVGMNTNCL	ASECFVKS	FGQDFKTFDL
PEDV	LNGNFYDFGD	FTCSIKMGV	PICTSYYSYM	MPVGMNTNCL	ASECFVKS	FGEDFKSYDL
TGEV	LNGNFYDFGD	FVKTAPGFGC	ACVTSYYSYM	MPLMGTMSCL	ESENFVKS	YGSDFKQYDL
OV43	LNGKWFDFGD	YVIAAPGCGV	AIADSYYSYM	MPMLTMCHAL	DCELYVNN--	---AYRLFDL
BoCoV	LNGKWFDFGD	YVIAAPGCGV	AIADSYYSYM	MPMLTMCHAL	DCELYVNN--	---AYRLFDL
MHV	LYGQWYDFGD	FVKTAPGCGV	AVADSYYSYM	MPMLTMCHAL	DSELFING--	---TYREFDL
AIBV	LNGKWFDFGD	FQKTAPGAGV	PVFDTSYYSYM	MPILMTDAL	APERFYFYDV	H-KGYKSYDL
SARS CoV	LNGNWFDFGD	FVQVAPGCGV	PIVDSYYSLL	MPILTLTRAL	AAESHMDADL	A-KPLIKWDL
	4865	4875	4885	4895	4905	4915
EMCR	LKYDFTEHKE	NLFNKYFKHW	SFDYHPNCSD	CYDDMCVHC	ANFNTLFATT	IPGTAFGPLC
229E	LKYDFTEHKE	NLFNKYFKYW	QDQYHPDCVD	CHDEMCIHC	SNFNTLFATT	IPNTAFGPLC
PEDV	LEYDFTEHKT	ALFNKYFKYW	GLQYHPNCSD	CSDEQCIHC	ANFNTLFSTT	IPITAFGPLC
TGEV	LAYDFTEHKE	YLFQKYFKYW	DRTYHPNCSD	CTSDECIHC	ANFNTLFSMT	IPMTAFGPLV
OV43	VQYDFTDYKL	ELFNKYFKHW	SMPYHPNTVD	CQDDRCIHC	ANFNILFSMV	LPNTCFGPLV
BoCoV	VQYDFTDYKL	ELFNKYFKHW	SMPYHPNTVD	CQDDRCIHC	ANFNILFSMV	LPNTCFGPLV
MHV	VQYDFTDYKL	ELFNKYFKYW	SMTYHPNTCE	CEDDRCIHC	ANFNILFSMV	LPKTCFGPLV
AIBV	LKYDYTEEKQ	ELFQKYFKYW	DQYHPNCSD	CSDDRCLHC	ANFNILFSTL	IPQTSFGNLC
SARS CoV	LKYDFTEERL	CLFDRYFKYW	DQYHPNCIN	CLDDRCILHC	ANFNVLFTSV	FPPTSFGPLV
	4925	4935	4945	4955	4965	4975
EMCR	RKVFIDGVPL	VTTAGYHFKQ	LGLVWKNQDV	THSVRLTITE	LLQFVTDPSL	IIASSPALVD
229E	RKVFIDGVPL	VATAGYHFKQ	LGLVWKNQDV	THSTRLTITE	LLQFVTDPTL	IVASSPALVD
PEDV	RKCVIDGVPL	VTTAGYHFKQ	LGLVWNNDLN	LHSSRLSINE	LLQFCDSPAL	LIASSPALVD
TGEV	RKVFIDGVPL	VTTAGYHFKQ	LGLVWNNDLN	LDTMKLSMTD	LLRFVTDPTL	LVASSPALLD
OV43	RQIFVDGVPP	VVSIGYHYKE	LGLVMMNDVD	THRYRLSLKD	LLLYAADPAL	HVASASALYD
BoCoV	RQIFVDGVPP	VVSIGYHYKE	LGLVMMNDVD	THRYRLSLKD	LLLYAADPAL	HVASASALYD
MHV	RQIFVDGVPP	VVSIGYHYKE	LGLVMMNDVD	THRYRLSLKD	LLLYAADPAL	HVASASALYD
AIBV	RKVFVDGVPP	IATCGYHSKE	LGLVMMNDNT	MSFSKMLSQ	LMQFVGDPAL	LVGTNNLVD
SARS CoV	RKIFVDGVPP	VVSTGYHFRE	LGLVMMNDVD	LHSSRLSFEK	LLVYAADPAL	HAASGNLLLD

	4985	4995	5005	5015	5025	5035
EMCR	QRTICFSVAA	LSTGLTNQVV	KPGHFNKEFY	NFLRLRGFFD	EGSELTCLKHF	FFAQNGDAAV
229E	KRTVCFSVAA	LSTGLTSQTV	KPGHFNKEFY	DFLRSGQFFD	EGSELTCLKHF	FFTQKGDAAV
PEDV	QRTVCFSVAA	LGTGMTNOTV	KPGHFNKEFY	DFLEQGFSS	EGSELTCLKHF	FFAQKVDAAV
TGEV	QRTVCFSVAA	LSTGITYQTV	KPGHFNKEFY	DFITERGFFE	EGSELTCLKHF	FFAQSGEAAV
OV43	LRTCCFSVAA	ITSGVKFQTV	KPGNFNQDFY	DFVLSKGLLK	EGSSVDLKHFF	FFTQDGNAAI
BoCoV	LRTCCFSVAA	ITSGVKFQTV	KPGNFNQDFY	DFVLSKGLLK	EGSSVDLKHFF	FFTQDGNAAI
MHV	LRTCCFSVAA	ITSGVKFQTV	KPGNFNQDFY	DFVLSKGLLK	EGSSVDLKHFF	FFTQDGNAAI
AIBV	LRTSCFSVCA	LTSGITHQTV	KPGHFNKEFY	DFAEKAGMFK	EGSSIPLKHFF	FYPQTGNAAI
SARS CoV	KRTTCFSVAA	LTNNVAFQTV	KPGNFNQDFY	DFAVSKGFFK	EGSSVELKHFF	FFAQDGNAAI

	5045	5055	5065	5075	5085	5095
EMCR	KDFDYRYRNR	PTMLDQCQAR	VTYKIVSRFY	DIYEGGCICA	CEVVVTNLNK	SAGWPLNKF
229E	KDFDYRYRNR	PTMLDQCQAR	VAYQVAARYF	DCYEGGCITS	REVVTNLNK	SAGWPLNKF
PEDV	KDFDYRYRNR	PTVLDICQAR	VYQIVQRYF	DIYEGGCITA	KEVVVTNLNK	SAGYPLNKF
TGEV	TDYNYRYRNR	VTVLDICQAO	FVYKIVGKYF	ECYDGGCINA	REVVTNNDK	SAGYPLNKF
OV43	TDYNYRYRNR	PTMVDIKQLL	FVLEVVKYF	EYDGGCIPA	SQVIVNNYDK	SAGYFNNKF
BoCoV	TDYNYRYRNR	PTMVDIKQLL	FVLEVVKYF	EYDGGCIPA	SQVIVNNYDK	SAGYFNNKF
MHV	TDYNYRYRNR	PTMVDIKQLL	FVLEVVKYF	EYDGGCIPA	SQVIVNNYDK	SAGYFNNKF
AIBV	NDYDYRYRNR	PTMFDICQLL	FCLEVTSKYF	ECYEGGCIPA	SQVVNNLDK	SAGYFNNKF
SARS CoV	SDYDYRYRNR	PTMCDIRQLL	FVLEVVDKYF	DCYDGGCINA	NQVIVNNLDK	SAGYFNNKF

	5105	5115	5125	5135	5145	5155
EMCR	KASLYYESIS	YEEQDALFAL	TKRNVLPMT	QLNLKYAISG	KERARTVGGV	SLLSTMTTRQ
229E	KAGLYYESIS	YEEQDAIFSL	TKRNLPTMT	QLNLKYAISG	KERARTVGGV	SLLATMTTRQ
PEDV	KAGLYYESIS	YEEQDELYAY	TKRNLPTMT	QLNLKYAISG	KERARTVGGV	SLLSTMTTRQ
TGEV	KARLYYETLS	YEEQDALFAL	TKRNVLPMT	QMNLYAISG	KARARTVGGV	SLLSTMTTRQ
OV43	KARLYYEALS	FEEQDEIYAY	TKRNVLPMT	QMNLYAISG	KARARTVAGV	SILSTMTGRM
BoCoV	KARLYYEALS	FEEQDEIYAY	TKRNVLPMT	QMNLYAISG	KARARTVAGV	SILSTMTGRM
MHV	KARLYYEALS	FEEQDEIYAY	TKRNVLPMT	QMNLYAISG	KARARTVAGV	SILSTMTGRM
AIBV	KARLYYEMS-	LEEQDQLFEI	TKRNVLPMT	QMNLYAISG	KARARTVAGV	SILSTMTNRQ
SARS CoV	KARLYYDMS	YEDQDALFAY	TKRNVLPMT	QMNLYAISG	KARARTVAGV	SICSTMTNRQ

	5165	5175	5185	5195	5205	5215
EMCR	YHQKHLKSIV	NTRNATVVIG	TKFYGGWNN	MLRLTIDGVE	NPMLMGWDYP	KCDRALPNMI
229E	FHQKCLKSIV	ATRNATVVIG	TKFYGGWNN	MLKNLMADVD	DPKLMGWDYP	KCDRAMPSMI
PEDV	YHQKHLKSIV	NTRGASVVIG	TKFYGGWNN	MLKNLIDGVE	NPCLMGWDYP	KCDRALPNMI
TGEV	YHQKHLKSIA	ATRNATVVIG	STKFYGGWNN	MLKNLMRDVD	NGCLMGWDYP	KCDRALPNMI
OV43	FHQKCLKSIA	ATRGVPVVIG	TKFYGGWDD	MLRLIKDVO	NPVLMGWDYP	KCDRAMPNLL
BoCoV	FHQKCLKSIA	ATRGVPVVIG	TKFYGGWDD	MLRLIKDVO	NPVLMGWDYP	KCDRAMPNLL
MHV	FHQKCLKSIA	ATRGVPVVIG	TKFYGGWDD	MLRLIKDVO	SPVLMGWDYP	KCDRAMPNLL
AIBV	FHQKILKSIV	NTRNASVVIG	TKFYGGWNN	MLRLIQGVE	DPILMGWDYP	KCDRAMPNLL
SARS CoV	FHQKLLKSIA	ATRGATVVIG	TSKFYGGWNN	MLKTVYSQVE	TPHLMGWDYP	KCDRAMPNLL

	5225	5235	5245	5255	5265	5275
EMCR	RMISAMVLGS	KHVNCCCTVD	RFYRLGNELA	QVLTEVVYSN	GGFYFKPGGT	TSGDASTAYA
229E	RMLSAMILGS	KHVTCTASD	RFYRLGNELA	QVLTEVVYSN	GGFYFKPGGT	TSGDATTAYA
PEDV	RMISAMILGS	KHTTCCSSTD	RFYRLGNELA	QVLTEVVYSN	GGFYFKPGGT	TSGDATTAYA
TGEV	RMASAMILGS	KHVGCCCTND	RFYRLGNELA	QVLTEVVHCT	GGFYFKPGGT	TSGDGTATAYA
OV43	RIVSSLVLAR	KHETCCSQSD	RFYRLANECA	QVLSEIVMCG	GCYYVKPGGT	SSGDATTAYA
BoCoV	RIVSSLVLAR	KHEACCSQSD	RFYRLANECA	QVLSEIVMCG	GCYYVKPGGT	SSGDATTAYA
MHV	RISSLVLAR	KHDSCCSHTD	RFYRLANECA	QVLSEIVMCG	GCYYVKPGGT	SSGDATTAYA
AIBV	RTAASLVLAR	KHTNCCSWSE	RIYRLYNECA	QVLSETVLAT	GGIYVKPGGT	SSGDATTAYA
SARS CoV	RIMASLVLAR	KHNTCCNLSH	RFYRLANECA	QVLSEIVMCG	GSLYVKPGGT	SSGDATTAYA

	5285	5295	5305	5315	5325	5335
EMCR	NSIFNIFQAV	SSNINRLLSV	PSDSCNNVNV	RDQLRRLYDN	CYRLTSVEES	FIDDYYGYLR
229E	NSVFNIQAV	SSNINCVLSV	NSSNCNNFNV	KKLQRLYDN	CYRNSNVDES	FVDDFYGYLQ
PEDV	NSVFNIQAV	SANVNKLLSV	DSNVCHNLEV	QQLQRLYEC	CYRSTIVDDQ	FVVEYYGYLR
TGEV	NSAFNIFQAV	SANVNKLLGV	DSNACNNVTV	KSIOQRIYDN	CYRSSSIDE	FVVEYFSLR
OV43	NSVFNIQAV	SANVCALMSC	NGNKIEDLSI	RALQKRLYSH	VYRSDKVDST	FVTEYYEFLN
BoCoV	NSVFNIQAV	SANVCALMSC	NGNKIEDLSI	RALQKRLYSH	VYRSDMVDST	FVTEYYEFLN
MHV	NSVFNIQAV	SANVCALMSC	NGNKIEDLSI	RELQKRLYSH	VYRADHVDPA	FVNEYYEFLN
AIBV	NSVFNIQAT	SANVARLLSV	ITRDIVYDNI	KSLQYELYQQ	VYRRVNFDP	FVEKFYSYLC
SARS CoV	NSVFNIQAV	TANVNALLST	DGNKIADKYV	RNLQRLYEC	LYNRDNDVHE	FVDEFYAYLR

	5345	5355	5365	5375	5385	5395
EMCR	KHFSMMILSD	DGVVCYNKDY	AELGYIADIS	AFKATLYYQN	NVFMSTSKCW	VEEDLTGKGP
229E	KHFSMMILSD	DSVVCYNKTY	AGLGYIADIS	AFKATLYYQN	GVFMSTAKCW	TEEDLSIGPH
PEDV	KHFSMMILSD	DGVVCYNNDY	ASLGYVADLN	AFKAVLYYQN	NVFMASCKW	IEPDINKGPH
TGEV	KHFSMMILSD	DGVVCYNKDY	ADLGYVADLN	AFKATLYYQN	NVFMSTSKCW	VEPDLSVGP
OV43	KHFSMMILSD	DGVVCYNSDY	ASKGYIANIS	AFQQLVLYQN	NVFMSESKCW	VEHDINNGPH
BoCoV	KHFSMMILSD	DGVVCYNSDY	ASKGYIANIS	AFQQLVLYQN	NVFMSESKCW	VENDINNGPH
MHV	KHFSMMILSD	DGVVCYNSEF	ASKGYIANIS	AFQQLVLYQN	NVFMSEAKCW	VETDIEKGP
AIBV	KHFSMMILSD	DGVVCYNNLT	AKQGLVADIS	GFREVLYYQN	NVFMADSKCW	VEPDLEKGP
SARS CoV	KHFSMMILSD	DAVVCYNSNY	AAQGLVASIK	NFXAVLYYQN	NVFMSEAKCW	TETDLTKGPH

	5405	5415	5425	5435	5445	5455
EMCR	EFCSQHTMQI	VDKDGTYYLP	YDPSRILSA	GVFVDDVVKT	DAVVLLXRYV	SLAIDAYPLS
229E	EFCSQHTMQI	VDENGKYYLP	YDPSRIISA	GVFVDDITKT	DAVILLERYV	SLAIDAYPLS
PEDV	EFCSQHTMQI	VDEKGTYYLP	YDPSRILSA	GVFVDDVVKT	DAVVLLERYV	SLAIDAYPLS
TGEV	EFCSQHTLQI	VDPDGDYYLP	YDPSRILSA	GVFVDDIVKT	DNVIMLERYV	SLAIDAYPLT
OV43	EFCSQHTMLV	KMDGDDVYLP	YPNPSRILGA	GCFVDDLLKT	DSVLLIERFV	SLAIDAYPLV
BoCoV	EFCSQHTMLV	KMDGDDVYLP	YPVPSRILGA	GCFVDDLLKT	DSVLLIERFV	SLAIDAYPLV
MHV	EFCSQHTMLV	KMDGDEVYLP	YDPSRILGA	GCFVDDLLKT	DSVLLIERFV	SLAIDAYPLV
AIBV	EFCSQHTMLV	EVDGEPKYL	YDPSRILGA	GVFVDDVOKT	EPVAVMERYI	ALAIIDAYPLV
SARS CoV	EFCSQHTMLV	KQGDYVYLP	YDPSRILGA	GVFVDDIVKT	DGTLMIERFV	SLAIDAYPLT

	5465	5475	5485	5495	5505	5515
EMCR	KHPNSEYRKV	FYVLLDWVKH	LNKNLNEGVL	ESFSVTLLDN	QEDKFWCEDF	YASMYENSTI
229E	KHPKPEYRKV	FYALLDWVKH	LNKTLNEGVL	ESFSVTLLDE	HESKFWDESF	YASMYEKSTV
PEDV	KHENPEYKVV	FYVLLDWVKH	LYKTLNAGVL	ESFSVTLLDE	STAKFWDESF	YANMYEKSAV
TGEV	KHPKPAYQKV	FYVLLDWVKH	LQKNLNAAGVL	DSFSVTMLLE	GQDKFWSEEF	YASLYEKSTV
OV43	YHENEYQKV	FRVYLAYIKK	LYNDLGNQIL	DSYSVILSTC	DGQKFTDESF	YKNMYLRSV
BoCoV	YHENEYQKV	FRVYLEYIKK	LYNDLGNQIL	DSYSVILSTC	DGQKFTDESF	YKNMYLRSV
MHV	YHENPEYQNV	FRVYLEYIKK	LYNDLGNQIL	DSYSVILSTC	DGQKFTDETF	YKNMYLRSV
AIBV	YHENEYKVV	FRVLLAYIRK	LYQELSQNML	MDYSFVMDID	KGSKFWEQEF	YENMYRAPTT
SARS CoV	KHPNQEYADV	FRVLYQYIRK	LHDELTGHML	DMYSVMLTND	NTSRYWEPEF	YEAMYPHTPTV

	5525	5535	5545	5555	5565	5575
EMCR	LQAAAGLCVVC	GSQTVLRCDG	CLRKPMCLCTK	CAYDHVFGTD	HKFILAITPY	VCNASGCCVS
229E	LQAAAGLCVVC	GSQTVLRCDG	CLRRFMLCTK	CAYDHVFGTD	HKFILAITPY	VCNTSGCNVN
PEDV	LQAAAGLCVVC	GSQTVLRCDG	CLRRFMLCTK	CAYDHVIGTT	HKFILAITPY	VCCASDCGVN
TGEV	LQAAAGLCVVC	GSQTVLRCDG	CLRRPFLCTK	CAYDHVMGTG	HKFIMSITPY	VCSFNGCNVN
OV43	MQSVGACVVC	SSQTSLRCSG	CIRKPLLCCK	CCYDHVMATD	HKYVLSVSPY	VCNAPGCDVN
BoCoV	MQSVGACVVC	SSQTSLRCSG	CIRKPLLCCK	CCYDHVMATD	HKYVLSVSPY	VCNAPGCDVN
MHV	MQSVGACVVC	SSQTSLRCSG	CIRKPLLCCK	CAYDHVMSTD	HKYVLSVSPY	VCNSPGCDVN
AIBV	LQSCGVCVVC	NSQTSLRCSG	CIRKPLLCCK	CCYDHVMHTD	HKNVLSINPY	ICSQGLCGEA
SARS CoV	LQAVGACVLC	NSQTSLRCSG	CIRRPFLCCK	CCYDHVISTS	HKLVLVSVPY	VCNAPGCDVT

	5585	5595	5605	5615	5625	5635
EMCR	DVKKLYLGGL	NYCYTNHKKPQ	LSFPLCSAGN	IFGLYKNSAT	GSLOVEVFNR	LATSOWTDVR
229E	DVTKLYLGGL	NYCYVDHKKPH	LSFPLCSAGN	VFGLYKSSAL	GSMIDIVFNK	LSTDWSDIR
PEDV	DVTKLYLGGL	SYWCHHKKPR	LAFFPLCSAGN	VFGLYKNSAT	GSPDVEDFNR	IATSDWTDVS
TGEV	DVTKLYLGGL	SYCYMNHKKPQ	LSFPLCANGN	VFGLYKSSAV	GSEAVEDFNK	LAVSOWTNVE
OV43	DVTKLYLGGM	SYCEDHKKPQ	YSFKLVNMNG	VFGLYKQSCT	GSPYIDDFNR	IASCWTDVD
BoCoV	DVTKLYLGGM	SYCEDHKKPQ	YSFKLVNMNG	VFGLYKQSCT	GSPYIDDFNR	IASCWTDVD
MHV	DVTKLYLGGM	SYCEDHKKPQ	YSFKLVNMNG	VFGLYKQSCT	GSPYIDDFNK	IASCWTEVD
AIBV	DVTKLYLGGM	SYFCGNHKKPQ	LSIPLVSNGT	VFGIYRANCA	GSENVDDFNQ	LATTNWSIVE
SARS CoV	DVTQLYLGGM	SYCYCKSHKPP	ISFPLCANGQ	VFGLYKNTCV	GSDNVTDFNA	IATCOWTNAG

	5645	5655	5665	5675	5685	5695
EMCR	DYKLANDVKD	TLRLFAAETI	KAKEESVKSS	YAFATLKEVV	GPKEILLLWE	SGKVRPPLNR
229E	DYKLANDAKE	SLRLFAAETV	KAKEESVKSS	YAYATLKEIV	GPKEILLLWE	SGKAKPPLNR
PEDV	DYKLANDVKD	SLRLFAAETI	KAKEESVKSS	YACATLHEVV	GPKEILLLWE	VGRPKPPLNR
TGEV	DYKLANNVKE	SLKIFAAETV	KAKEESVKSE	YAYAVLKEVI	GPKEIVLQWE	ASKTKPPLNR
OV43	DYILANECTE	RLKLFAAETQ	KATEEAFKQS	YASATIQEIV	SERELILSWE	IGKVRPPLNK
BoCoV	DYILANECTE	RLKLFAAETQ	KATEEAFKQS	YASATIQEIV	SERELILSWE	IGKVRPPLNK
MHV	DYVLANECTE	RLKLFAAETQ	KATEESFKQC	YASATIREIV	SDRELILSWE	IGKVRPPLNK
AIBV	PYILANRCSO	SLRRFAAETV	KATEELHKQK	FASAEVREVF	SDRELILSWE	PGKTRPPLNR
SARS CoV	DYILANTCTE	RLKLFAAETL	KATEETFKLS	YGIATVREVL	SDRELILSWE	VGKPRPPLNR

	5705	5715	5725	5735	5745	5755
EMCR	NSVFTCFQIS	KDSKFQIGEF	IFERVEYGSO	TVTYKSTVTT	KLVPGMIFVL	TSHNVQPLRA
229E	NSVFTCFQIT	KDSKFQVGEF	VFERVDYGSO	TVTYKSTATT	KLVPGMIFVL	TSHNVAPLRA
PEDV	NSVFTCFQIT	KNTKFQIGEF	VFEKAEYDND	AVTYKTATT	KLVPGMIFVL	TSHNVQPLRA
TGEV	NSVFTCFQIS	KDKFIQIGEF	VFEQSEYGSO	SVYYKSTSTY	KLTPGMIFVL	TSHNVSPKLA
OV43	NYVFTGYHFT	KNGKTVLGEY	VFDKSELT-N	GVYYRATTY	KLTVGDDVFL	TSHSVANLSA
BoCoV	NYVFTGYHFT	KNGKTVLGEY	VFDKSELT-N	GVYYRATTY	KLTVGDDVFL	TSHSVANLSA
MHV	NYVFTGYHFT	SNGKTVLGEY	VFDKSELT-N	GVYYRATTY	KLTVGDDVFL	TSHSVSSLSA
AIBV	NYVFTGYHFT	RTSKVQLGDF	TFEKGEK-D	VVYYKATSTA	KLTVGDDVFL	TSHNVVSLVA
SARS CoV	NYVFTGYRVT	KNSKVQIGEF	TFEKGDYD	AVVYRGTTY	KLTVGDDVFL	TSHVMPLSA

	5765	5775	5785	5795	5805	5815
EMCR	PTIANQEKYS	SIYKLHPAFN	VSDAYANLVP	YYQLIGKQKI	TTIQGPPGSG	KSHCSIGLGL
229E	PTMANQEKYS	TIYKLHPFEN	VSDAYANLVP	YYQLIGKQRI	TTIQGPPGSG	KSHCSIGIGV
PEDV	PTIANQERYS	TIHKLHPAFN	IPEAYSSLVP	YYQLIGKQKI	TTIQGPPGSG	KSHCVIGLGL
TGEV	PILVNQEKYN	TISKLYPVFN	IAEAYNTLVP	YYQMIGKQKF	TTIQGPPGSG	KSHCVIGLGL
OV43	PTLVQENYS	SIR-FASVYS	VLETFFQNNVV	NYQHIGMKRY	CTVQGPPTGT	KSHLAIGLAV
BoCoV	PTLVQENYS	SIR-FASVYS	VLETFFQNNVV	NYQHIGMKRY	CTVQGPPTGT	KSHLAIGLAV
MHV	PTLVQENYT	SIR-FASVYS	VPETFFQNNVP	NYQHIGMKRY	CTVQGPPTGT	KSHLAIGLAV
AIBV	PTLCQQTFS	RFVNLRPVNM	VPECFVNNIP	LYHLVGKQKR	TTVQGPPTGT	KSHFAIGLAV
SARS CoV	PTLVQEHYV	RITGLYPTLN	ISDEFSSNVA	NYQKVGMOQRY	STLQGPPTGT	KSHFAIGLAV

	5825	5835	5845	5855	5865	5875
EMCR	YYPGARIVFV	ACAHAAVDSL	CAKAMTVYSI	DKCTRIIPAR	ARVECYSGFK	PNNTSAQYIF
229E	YYPGARIVFT	ACSHAAVDSL	CAKAVTAYSV	DKCTRIIPAR	ARVECYSGFK	PNNTSAQYVF
PEDV	YYPGARIVFT	ACSHAAVDSL	CVKASTAYSN	DKCSRIIPQR	ARVECYDGFK	SNNTSAQYLF
TGEV	YYPQARIVYT	ACSHAAVDAL	CEKAAKNFNV	DRCSRIIPQR	IRVDCYTGFK	PNNTNAQYLF
OV43	FYCTARVVYT	AASHAAVDAL	CEKAYKFLNI	NDCTRIVPAK	VRVECYDKFK	INDTTRKYVF
BoCoV	YYCTARVVYT	AASHAAVDAL	CEKAYKFLNI	NDCTRIVPAK	VRVECYDKFK	INDTTRKYVF
MHV	YYCTARVVYT	AASHAAVDAL	CEKAYKFLNI	NDCTRIVPAK	VRVDCYDKFK	VNDTTRKYVF
AIBV	YFSSARVVFT	ACSHAAVDAL	CEKAFKFLKV	DDCTRIVPQR	TTVDCFSKFK	ANDTGKKYIF
SARS CoV	YYPSARIVYT	ACSHAAVDAL	CEKALKYLP	DKCSRIIPAR	ARVECFDKFK	VNSTLEQYVF

	5885	5895	5905	5915	5925	5935
EMCR	STVNALPECN	ADIVVVDEVS	MCTNYDLSVI	NQRLSYKHIV	YVGDPQQLPA	PRVMITKGVM
229E	STVNALPEVN	ADIVVVDEVS	MCTNYDLSVI	NQRISYKHIV	YVGDPQQLPA	PRVLISKGVM
PEDV	STVNALPECN	ADIVVVDEVS	MCTNYDLSVI	NQRISYRHVV	YVGDPQQLPA	PRVMISRGTL
TGEV	CTVNALPEAS	CDIVVVDEVS	MCTNYDLSVI	NSRLSYKHIV	YVGDPQQLPA	PRTLKNGKVL
OV43	TTINALPEMV	TDIVVVDEVS	MLTNYELSVI	NARIRAKHYV	YIGDPAQLPA	PRVLLSKGTL
BoCoV	TTINALPEMV	TDIVVVDEVS	MLTNYELSVI	NARIRAKHYV	YIGDPAQLPA	PRVLLSKGTL
MHV	TTINALPELV	TDIIVVDEVS	MLTNYELSVI	NSRVRARHYV	YIGDPAQLPA	PRVLLNKGTL
AIBV	TTINALPEVS	CDILLVDEVS	MLTNYELSVI	NGKINYQYVV	YVGDPQQLPA	PRTLNLN-GSL
SARS CoV	CTVNALPETT	ADIVVFDEIS	MATNYDLSVV	NARLRARHYV	YIGDPAQLPA	PRTLTLTKGTL

	5945	5955	5965	5975	5985	5995
EMCR	EPVDYNNVTQ	RMCAIGPDVF	LHKCYRCPAE	IVNTVSELVY	ENKFVPVKEA	SKQCCKIFFK
229E	EPIDYNNVTQ	RMCAIGPDVF	LHKCYRCPAE	IVNTVSELVY	ENKFVPVKEA	SKQCCKIFER
PEDV	EPKDYNNVTQ	RMCAIKPDVF	LHKCYRCPAE	IVRTVSEMVY	ENQFIPVHPD	SKQCCKIFCK
TGEV	QPQDYNNVTQ	RMCTLGPDVF	LHKCYRCPAE	IVKTVSALVY	ENKFVPVNPE	SKQCCKMFVK
OV43	EPKYFNTVTK	LMCCLGPDIF	LGTCYRCPKE	IVDTVSALVY	ENKLLAKKNES	SSLCFKVYYK
BoCoV	EPKYFNTVTK	LMCCLGPDIF	LGTCYRCPKE	IVDTVSALVY	ENKLLAKKNES	SSLCFKVYYK
MHV	EPRYFNSVTK	LMCCLGPDIF	LGTCYRCPKE	IVDTVSALVY	HNKLLAKKNDN	SSMCFKVVYK
AIBV	SPKDYNNVTN	LMVCVKPDIF	LAKCYRCPKE	IVDTVSTLVY	DGKFIANNPE	SRECFKVIYN
SARS CoV	EPEYFNSVCR	LMKTIGPDMF	LGTCRRCPAE	IVDTVSALVY	DNKLLAKHKDK	SAQCCKMFVK

	6005	6015	6025	6035	6045	6055
EMCR	---GNVQVDN	GSSINRRQLE	IVKFLVKNP	SWSKAVFISP	YNSQNYVASR	FLGLQIQTV
229E	---GSVQVDN	GSSINRRQLD	VVKRFIHKNS	TWSKAVFISP	YNSQNYVAAR	LLGLQIQTV
PEDV	---GNVQVDN	GSSINRRQLD	VVRMFLAKNP	RWSKAVFISP	YNSQNYVASR	LLGLQIQTV
TGEV	---GQVQIES	NSSINNRQLE	VVKAFLAHNP	KWRKAVFISP	YNSQNYVARR	LLGLQIQTV
OV43	---GVTTHES	SSAVNMQQIY	LINKFLKANP	LWHKAVFISP	YNSQNFPAKR	VLGLQIQTV
BoCoV	---GVTTHES	SSAVNMQQIY	LINKFLKANP	LWHKAVFISP	YNSQNFPAKR	VLGLQIQTV
MHV	---GQTHES	SSAVNMQQIY	LISKFLKANP	SWSNAVFISP	YNSQNYVAKR	VLGLQIQTV
AIBV	NGNSDVGHES	GSAYNTTQLE	FKVDFVCRNK	QWREAFISP	YNAMNQRAYR	MLGLNVQTV
SARS CoV	---GVITHOV	SSAINRPQIG	VVREFLTRNP	AWRKAVFISP	YNSQNAVASK	ILGLPTQTV

	6065	6075	6085	6095	6105	6115
EMCR	SSQGSSEYDYV	IYAQTSDDTAH	ACNVNRFNVA	ITRAKKGIFC	VMCDRT-LFD	SLKFFFEIKHA
229E	SAQGSSEYDYV	IFAQTSDDTAH	ACNANRFNVA	ITRAKKGIFC	IMSDRT-LFD	ALKFFFEITMT
PEDV	SSQGSSEYDYV	IYAQTSDDTAH	ASNVNRFNVA	ITRAKKGILC	IMCDRS-LFD	LLKFFFLKLS
TGEV	SAQGSSEYDYV	IYTQTSDDTAH	ATNVNRFNVA	ITRAKKGILC	IMCDRT-MYE	NLDFYELKDS
OV43	SAQGSSEYDYV	IYSQTAETAH	SVNVNRFNVA	ITRAKKGILC	VMSNMQ-LFE	ALQFTTLTLD
BoCoV	SAQGSSEYDYV	IYSQTAETAH	SVNVNRFNVA	ITRAKKGILC	VMSNMQ-LFE	ALQFTTLTLD
MHV	SAQGSSEYDFV	IYSQTAETAH	SVNVNRFNVA	ITRAKKGILC	VMSNMQ-LFE	SLNFSTLTLD
AIBV	SSQGSSEYDYV	IFCVTADSQH	ALNVNRFNVA	LTRAKRGIIV	VMRQRDELVS	ALKFTELDSE
SARS CoV	SSQGSSEYDYV	IFTQTETTAH	SCNVNRFNVA	ITRAKIGILC	IMSDRD-LYD	KLQFTSLLEP

	6125	6135	6145	6155	6165	6175
EMCR	-----DLHSS	-QVCGLFKNC	TRTPNLNPPT	HAHTFLSLSD	QFKTTGDLAV	QIGS-N-NVC
229E	-----DLQSE	-SSCGLFKDC	ARNPIDLPPS	HATTYLSLSD	RFKTSGDLAV	QIGN-N-NVC
PEDV	-----DLQAN	-EGCGLFKDC	SRGDDLLPPS	HANTFMSLAD	NFKTDQYLAV	QIGV-N-GPI
TGEV	-----GLQAK	PETCGLFKDC	SKSEQYIPPA	YATTYMSLSD	NFKTSDGLAV	NIG--T-KDV
OV43	KVPQAVETRV	QCSTNLFKDC	SKSYSGYHPA	HAPSFLAVDD	KYKATGDLAV	CLGIGD-SAV
BoCoV	KVPQAVETRV	QCSTNLFKDC	SKSYSGYHPA	HAPSFLAVDD	KYKATGDLAV	CLGIGD-SAV
MHV	KIN---NPRL	QCTTNLFKDC	SRSYAGYHPA	HAPSFLAVDD	KYKVGDLAV	CLNVAD-SAV
AIBV	T-----S--	LQGTGLFKIC	NKEFSGVHPA	YAVTTKALAA	TYKVNDLAA	LVNVEAGSEI
SARS CoV	RRN-VATLQA	ENVGTGLFKDC	SKIITGLHPT	QAPTHLSVDI	KFKTEG-LCV	DIPGIP-KDM

	6185	6195	6205	6215	6225	6235
EMCR	TYEHVISFMG	FRFDISIPGS	HSLFCTRDFA	IRNVRGWLG	DVEGAHVCGD	NIGTNVPLQV
229E	TYEHVISFMG	FRFDVSMGPS	HSLFCTRDFA	MRHVRGWLG	DVEGAHVTDG	NVGTNVPLQV
PEDV	KYEHVISFMG	FRFDINIPNH	HTLFCTRDFA	MRNVRGWLG	DVEGAHVVG	NVGTNVPLQL
TGEV	KYANVISFMG	FRFEANIPGY	HTLFCTRDFA	MRNVRAWLG	DVEGAHVCGD	NVGTNVPLQL
OV43	TYSRILSLMG	FKLDVTLDDY	CKLFITKEEA	VKRVRWVGF	DAEGAHAATRD	SIGTNFPLQL
BoCoV	TYSRILSLMG	FKLDVTLDDY	CKLFITKEEA	VKRVRWVGF	DAEGAHAATRD	SIGTNFPLQL
MHV	TYSRILSLMG	FKLDLTLDDY	CKLFITRDEA	IRVRWVGF	DAEGAHAATRD	SIGTNFPLQL
AIBV	TYKHLISLLG	FKMSVNVGCG	HNMFITRDEA	IRNVRGWVGF	DVEATHACGT	NIGTNLPFQV
SARS CoV	TYRRLISMGG	FKMNYQVNGY	PNMFITRDEA	IRHVRWVGF	DVEGCHATRD	AVGTNLPQL

	6245	6255	6265	6275	6285	6295
EMCR	GFSNGVNEFV	QTEGCVSTNF	GDVIRPVCAK	SPPGEQFRHL	VPFLRKGQPW	LIVRRRIVQM
229E	GFSNGVDFA	QPEGCVLTNT	GSVVKPVRAR	APPGEQFTHI	VPLLRKGQPW	SVLRKRIVQM
PEDV	GFSNGVDFFV	RPEGCVVTES	GDYIKPVRAR	APPGEQFAHL	LPLLRKGQPW	DVVRKRIVQM
TGEV	GFSNGVDFFV	QTEGCVITEK	GNSIEVVKAR	APPGEQFAHL	IPLMRKGQPW	HIVRRRIVQM
OV43	GFSTGIDFVV	EATGLFADRD	GYSFKKAVAK	APPGEQFKHL	IPLMTRGHRW	DVVRPRIVQM
BoCoV	GFSTGIDFVV	EATGLFADRD	GYSFKKAVAK	APPGEQFKHL	IPLMTRGHRW	DVVRPRIVQM
MHV	GFSTGIDFVV	EATGMFAERD	GYVFKKAVAR	APPGEQFKHL	VPLMSRGQKW	DVVRIRIVQM
AIBV	GFSTGADFVV	TPEGLVDTSI	GNNFEPVNSK	APPGEQFNHL	RVLFKSAKPW	HVIRPRIVQM
SARS CoV	GFSTGVNLVA	VPTGVVDTEN	NTEFTRVNAK	PPPGDQFKHL	IPLMYKGLPW	NVVRIRIVQM

	6305	6315	6325	6335	6345	6355
EMCR	ISDYLSNLSL	ILVFLVWAGS	LELTMMRYFV	KIGP-IKYCY	CGNSATCYNS	VSNEYCCFKH
229E	IADFLAGSSD	VLVFLVWAGG	LELTMMRYFV	KIGA-VKHCC	CGTVATCYNS	VSNDYCCFKH
PEDV	CSDYLANLSL	ILVFLVWAGG	LELTMMRYFV	KIGP-SKSCD	CGKVATCYNS	ALHTYCCFKH
TGEV	VCDYFDGLSD	ILVFLVWAGG	LELTMMRYFV	KIGR-PQKCE	CGKSATCYSS	SQSVYACFKH
OV43	FADHLIDLSD	CVVLVTWAAN	FELTCLRYFA	KVGREISCNV	CTKRATVYNS	RTGYYGCWRH
BoCoV	FADHLIDLSD	CVVLVTWAAN	FELTCLRYFA	KVGREISCNV	CTKRATVYNS	RTGYYGCWRH
MHV	LSDKLVDLAD	SVVLVTWAAS	FELTCLRYFA	KVGREVVCSV	CNKRATCFNS	RTGYYGCWRH
AIBV	LADNLCNVSD	CVFVTVCHG	LELTLLRYFV	KIGK-EQVCS	CGSRATTENS	HTQAYACWKH
SARS CoV	LSDTLKLGLSD	RVVFLVWAGH	FELTSMKYFV	KIGPERTCCL	CDKRATCFST	SSDTYACWNH

	6365	6375	6385	6395	6405	6415
EMCR	ALGCDYVYNP	YAFDIQQWGY	VGSLSQNHHT	FCNIHRNEHD	ASGDAVMTRC	LAVHDCFVKH
229E	ALGCDYVYNP	YVIDIQQWGY	VGSLSTNHHA	ICNVHRNEHV	ASGDAIMTRC	LAVYDCFVKH
PEDV	ALGCDYLYNP	YCIDIQQWGY	KGSLSLNHHE	HCNVHRNEHV	ASGDAIMTRC	LAIHDCFVKH
TGEV	ALGCDYLYNP	YCIDIQQWGY	TGSLSMNHHE	VCNIHRNEHV	ASGDAIMTRC	LAIHDCFVKR
OV43	SVTCODYLYNP	LIVDIQQWGY	IGSLSSNHDL	YCSVHKGAHV	ASSDAIMTRC	LAVYDCFCNN
BoCoV	SVTCODYLYNP	LIVDIQQWGY	IGSLSSNHDL	YCSVHKGAHV	ASSDAIMTRC	LAVYDCFCNN
MHV	SYSCODYLYNP	LIVDIQQWGY	TGSLTNNHDL	ICSVHKGAHV	ASSDAIMTRC	LAVHDCFCCK
AIBV	CLGDFDVYNP	LLVDIQQWGY	SGNLQFNHDL	HCNVHGHNAHV	ASVDAIMTRC	LAINNAFCOD
SARS CoV	SVGDFDVYNP	FMIDVQQWGF	TGNLQSNHDO	HCQVHGNAHV	ASCDAIMTRC	LAVHECFVKR

	6425	6435	6445	6455	6465	6475
EMCR	VDWTVTYPII	ANEKFINCGG	RNVQGHVVRA	ALKLYKPSVI	HDIGNPKGVR	CA-VTDAKWY
229E	VDWSITYPMI	ANENAINKGG	RTVQSHIMRA	AIKLYNPKAI	HDIGNPKGIR	CA-VTDAKWY
PEDV	VDWSITYPFI	GNEAVINKSG	RIVQSHTMRS	VLKLYNPKAI	YDIGNPKGIR	CA-VTDAKWF
TGEV	VDWSIVYPII	DNEEKINKAG	RIVQSHVMKA	ALKIFNPAAI	HDVGNPKGIR	CA-TTPIPFW
OV43	INWNVEYPII	SNELSINTSC	RVLQRVILKA	AMLCNRYTLC	YDIGNPKAIA	CV--KDFDFK
BoCoV	INWNVEYPII	SNELSINTSC	RVLQRVILKA	AMLCNRYTLC	YDIGNPKAIA	CV--KDFDFK
MHV	VNWSLEYPII	SNEVSNTTSC	RLQRVMFRA	AMLCNRYDVC	YDIGNPKGLA	CV--KGYDFK
AIBV	VNWDLYPHI	ANEDEVNSSC	RYLQRMVILNA	CVDAKVNNVV	YDIGNPKGIK	CVRRGDVNF
SARS CoV	VDWSVEYPII	GDELRVNSAC	RKVQHMVVK	ALLADEFPVL	HDIGNPKAIK	CVQAEVEWK

	6485	6495	6505	6515	6525	6535
EMCR	CYDKQPVNSN	---VKLLDYD	YATHG--QLD	GLCLFWNCNV	DMYPEFSIVC	RFDTRTSVF
229E	CYDKNPINSN	---VKTLEYD	YMTG--QMD	GLCLFWNCNV	DMYPEFSIVC	RFDTRTRSTL
PEDV	CFDKNPTNSN	---VKTLEYD	YITHG--QFD	GLCLFWNCNV	DMYPEFSVVC	RFDTRCRSPL
TGEV	CYDRDPINNN	---VRCLDYD	YMHG--QMN	GLMLFWNCNV	DMYPEFSIVC	RFDTRTRSKL
OV43	FYDAQPIVKS	---VKTLLYS	FEAHKDSFKD	GLCMFWNCNV	DKYPANAVVC	RFDTRVLNNL
BoCoV	FYDAQPIVKS	---VKTLLYS	FEAHKDSFKD	GLCMFWNCNV	DKYPANAVVC	RFDTRVLNNL
MHV	FYDASPVVKS	---VKQFVYK	YEAHKDQFLD	GLCMFWNCNV	DKYPANAVVC	RFDTRVLNNL
AIBV	FYDKNPVIRN	---VKQFEYD	YNQHKDKFAD	GLCMFWNCNV	DCYPDNSLVC	RYDTRNLSVF
SARS CoV	FYDAQPCSDK	AYKIEELFYS	YATHHOKFTD	GVCLFWNCNV	DRYPANAIVC	RFDTRVLNNL

	6545	6555	6565	6575	6585	6595
EMCR	NLEGVNGGSL	YNNKHAFTPT	AYDKRAFVKL	KPMPPFFYDD	SDCDVVQ---	-EQVNYVPLR
229E	NLEGVNGGSL	YNNKHAFTPT	AYDKRAMAKL	KPAFFFFYYDD	GSCEVVH---	-DQVNYVPLR
PEDV	NLEGCGGGSL	YNNKHAFTPT	AFDKRAFAKL	KPMPPFFYYDD	TECDKLQ---	-DSINYVPLR
TGEV	SLEGCGGGAL	YNNKHAFTPT	AYDRRAFAKL	KPMPPFFYYDD	SNCELVD---	-GQPNYVPLK
OV43	NLPGCGGGSL	YNNKHAFTK	PFARAAFEHL	KPMPPFFYYSD	TPCVYMDGMD	AKQVDYVPLK
BoCoV	NLPGCGGGSL	YNNKHAFTK	PFARAAFEHL	KPMPPFFYYSD	TPCVYMDGMD	AKQVDYVPLK
MHV	NLPGCGGGSL	YNNKHAFTS	PETRAAFENL	KPMPPFFYYSD	TPCVYMEGME	SKQVDYVPLR
AIBV	NLPGCGGGSL	YNNKHAFTPT	KFDRISFRNL	KAMPFFYYDS	SPCETIQVDG	-VAQDLVSLA
SARS CoV	NLPGCDGGSL	YNNKHAFTPT	AFDKSAFTNL	KQLPFFYYSD	SPCESHGKQV	VSDIDYVPLK

	6605	6615	6625	6635	6645	6655
EMCR	ASSCVTRCNI	GGAVCSKHAN	LYQKYVEAYN	TFTQAGFNIW	VPHSFDVYNL	WQIFIET-NL
229E	ATNCITKCN	GGAVCSKHAN	LYRAYVESYN	IFTQAGFNIW	VPTTFDCYNL	WQTFTEV-NL
PEDV	ASNCITKCNV	GGAVCSKHCA	MYHSYVNAYN	TFTSAGFTIW	VPTSFDOTYNL	WQTFSEN-NL
TGEV	SNVCITKCN	GGAVCKKHAH	LYRAYVEDYN	IFMQAGFTIW	CPQNFDOTYML	WHGFVNSKAL
OV43	SATCITRCNL	GGAVCLKHAE	EYREYLESYN	TATTAGFTFW	VYKTFDFYNL	WNTFTK---L
BoCoV	SATCITRCNL	GGAVCLKHAE	EYREYLESYN	TATTAGFTFW	VYKTFDFYNL	WNTFTK---L
MHV	SATCITRCNL	GGAVCLKHAE	DYREYLESYN	TATTAGFTFW	VYKTFDFYNL	WNTFTK---L
AIBV	TKDCITKCN	GGAVCKKHAQ	MYAEFVTSYN	AAVTAGFTFW	VTKLNPNYNL	WKSFSFA---L
SARS CoV	SATCITRCNL	GGAVCRHHAN	EYRQYLDAYN	MMISAGFSLW	IYKQFOTYNL	WNTFTK---L

	6665 6675 6685 6695 6705 6715
EMCR	QSLFNIAFNV VKKGCFTGVD GELPVAVVD KVFVRYGDDV NLVFTNKTTL PTNVAFELFA
229E	QGLFNIAFNV VNKGSFVGAD GELPVAISGD KVFVRDGNDD NLVFNKTSLS PTNIAFELFA
PEDV	QGLFNIAFNV LKKGSEFVGDE GELPVAVVD KVLVRDGTVD TLVFTNKTSLS PTNVAFELFA
TGEV	QSLFNIAFNV VKKGAFTGLK GDLPTAVIAD KIMVRDGTVD KCIFTNKTSLS PTNVAFELFA
OV43	QSLFNIAFNV VKTGHYTGQA GEMPCAIIND KVVAKIDKED VVIFINNTTY PTNVAVELFA
BoCoV	QSLFNIAFNV VKTGHYTGQA GEMPCAIIND KVVAKIDKED VVIFINNTTY PTNVAVELFA
MHV	QSLFNIAFNV VNAGHFDGRA GELPCAVIGE KVIKIQNED VVVFKNNTPF PTNVAVELFA
AIBV	QSIDNIAYNM YKGGHYDAIA GEMPTVITGD KVFVIDQGE KAVFVNQTTL PTSVAFELFA
SARS CoV	QSLFNIAFNV VNKGHFDGHA GEAPVSIINN AVYTKVDGID VEIFENKTTL PVNVAFELFA

	6725 6735 6745 6755 6765 6775
EMCR	KRKMGTLTPLL SILKNLGVVA TYKFLWDYE AERPFTSYTK SVCKYTDEN-----EDV
229E	KRKMGTLTPLL SILKNLGVVA TYKFLWDYE AERPLTSFTK SVCKYTDFA-----EDV
PEDV	KRKMGTLTPLL TILRNLGVC TSKCVIWDYE AERPLTFTK DVCKYTDFA-----GDV
TGEV	KRKMGTLTPLL TILRNLGVC TYKFLWDYE AERPFSNFTK QVCSYTDLD-----SEV
OV43	KRSVRHHPKL KLFRLNIDV CWKHVIWDYA RESIFCSNTY GVCMTYDLK-----FIDKL
BoCoV	KRSVRHHPKL KLFRLNIDV CWKHVIWDYA RESIFCSNTY GVCMTYDLK-----LIDKL
MHV	KRSVRHHPKL KLFRLNIDV CWKHVIWDYA KDSVFCSSY KVCKYTDLQ-----CIESL
AIBV	KRNIRTLFNN RILKGLGVDV TNGFVIWDYA NQTPLYRNTV KVCAYTDIE-----BNGL
SARS CoV	KRNIRTLFNN RILKGLGVDV TNGFVIWDYA REAPAHVSTI GVCMTYDIK KPTESACSSL

	6785 6795 6805 6815 6825 6835
EMCR	CVCFDNSIQG SYERFTLTNN AVLFSTVVIK N-----LTPIK LNFVGLNGMP VSSIKSDKGV
229E	CTCYDNSIQG SYERFTLTNN AVLFSTVVIK TGGKSLPAIK LNFVGLNGMA IATVKSSEDGN
PEDV	CTCYDNSIQG SLERFSMTQN AVLFSTVVIK K-----LTGIR LTYGYLNGVP VN---THED-
TGEV	VTCFDNSIQG SFERFTTTTRD AVLFSTVVIK G-----LSAIA LQYGLNDLP VS---TVGN-
OV43	NVLFDRDNG ALEAFKRSNN GVIYSTTKVK S-----LS MIRGPPRAEL NGVVVDKVDG
BoCoV	NVLFDRDNG ALEAFKRSNN GVIYSTTKVK S-----LS MIRGPPRAEL NGVVVDKVDG
MHV	NVLFDRDNG ALEAFKRSNN GVIYSTTKVK S-----LS MIRGPPRAEL NGVVVDKVDG
AIBV	VVLYDDR-YG DYQSFLAADD AVLFSTVVIK R-----YS YVEIPSNLLV QNGMPLKDG-
SARS CoV	TVLFDRDNG QVDFLRNARN GVLITEGSKV G-----LT PSKGPAAQSV NGVTLIGES-

	6845 6855 6865 6875 6885 6895
EMCR	EKLNVWYTYV RKNQGFQDHY DG----- FTTQ
229E	IKNINWFVYV RKDGKPVVDY DG----- FTTQ
PEDV	-KPFWTYIYT RKNQGFQDHY DG----- YFTQ
TGEV	-KPFWTYIYT RKNQGFQDHY DS----- YFTQ
OV43	-TDCVFYFAV RKEGQDVIFS QFDSLGVSSN QSPQGNLGSN GKPQNVGGND ALSISTIFTQ
BoCoV	-TDCVFYFAV RKEGQDVIFS QFDSLGVSSN QSPQGNLGSN GKPQNVGGND ALATSTIFTQ
MHV	-SDVEFWFAM RRDGDDVIFS RTGSLPESHY RSPQGNPQGN -RVGDLGNE ALARGTIFTQ
AIBV	-ANLYVYK RVNGAFVTLN N----- TINTQ
SARS CoV	-VKTQFNYFK KVDG--IIQ----- QLP----- ETYFTQ

	6905 6915 6925 6935 6945 6955
EMCR	GRNLSDFTPR SDMEYDFLNM DMGVFIQKYG LEDFNFHEHV YGDVSKTTLG GLHLLISQFR
229E	GRNLSDFTPR STMEEDFLNM DIGVFIQKYG LEDFNFHEHV YGDVSKTTLG GLHLLISQFR
PEDV	GRTTADFSPR SDMEKDFLSM DMGLFIQKYG LEDYGFHEHV YGDVSKTTLG GLHLLISQFR
TGEV	GRTTADFSPR STMEEDFLNM DTLFIQKYG LEDYGFHEHV YGDVSKTTLG GLHLLISQFR
OV43	SRVSSFTCR TDMKDFIAL QDQVFIQKYG LEDYAFHEHV YGNFNQKIIG GLHLLIGLYR
BoCoV	SRVSSFTCR TDMKDFIAL QDQVFIQKYG LEDYAFHEHV YGNFNQKIIG GLHLLIGLYR
MHV	SRFLSSFAPR SEMEKDFMOL DEDVFIQKYG LQDYAFHEHV YGSFNQKIIG GLHLLIGLYR
AIBV	GRSYETFEPR SDIERDFLAM SEESFVERYG -KDLGLQHL YGEVDKPLQGL GLHTVIGMYR
SARS CoV	SRDLEDFKPR SQMETDFLEL AMDEFTQRYK LEGYAFHEHV YGDFSHGQLG GLHLLIGLYR

	6965 6975 6985 6995 7005 7015
EMCR	LSKMGVLKAD DFVTASDTTL RCCTVTYLYNE LSSKVVCTYM DLLLDDFVTI LK---SLDLG
229E	LSKMGVLKAE EFVAASDITL KCCTVTYLYNE PSSKTVCTYM DLLLDDFVSV LK---SLDLT
PEDV	LACMGVLKID EFWSSNDSTL KSCTVTYADN PSSKVMCTYM DLLLDDFVSI LK---SLDLG
TGEV	LAKMGVLSVQ EFMNNSDSTL KSCTVTYADN PSSKVMCTYM DLLLDDFVTI LK---SLDLN
OV43	RQQTSLNLVQ EFVS-YDSSI HSYFITDEKS GGSKSVCVTI DILLDDFVAL VK---SLNEN
BoCoV	RQQTSLNLVQ EFVS-YDSSI HSYFITDEKS GGSKSVCVTI DILLDDFVAL VK---SLNEN
MHV	RQQTSLNLVQ EFVS-YDSSI HSYFITDEKS GGSKSVCVTI DILLDDFVAL VK---SLNEN
AIBV	LLRANKLNAK SVTN-SOSDV MQNYFVLSN GSYKQVCTV DILLDDFLEL LRNLKEYGT
SARS CoV	RSQDSPLKLE DFIP-MDSTV KNYFITDAQT GSSKVCVSVI DILLDDFVEI LK---SQDLS

	7025 7035 7045 7055 7065 7075
EMCR	VISKVHEVII DNKPYRWMLW CKDNHLSFTY POLQS-AEWK CGYAMPQIYK LQRMCLPCN
229E	VISKVHEVII DNKPYRWMLW CKDNHLSFTY POLQS-AEWK CGYAMPQIYK LQRMCLPCN
PEDV	VISKVHEVII DNKPYRWMLW CKDNHLSFTY POLQS-AEWK CGYAMPQIYK LQRMCLPCN
TGEV	VISKVHEVII DNKPYRWMLW CENSHIKTFY POLQS-AEWK PGYSMPPLYK LQRMCLPCN
OV43	CVSKVNVNVV DFKDFQFMLW CNDEKVMTEY PRLQAASDWK PGYSMPPLYK YLNSPMERVS
BoCoV	CVSKVNVNVV DFKDFQFMLW CNDEKVMTEY PRLQAASDWK PGYSMPPLYK YLNSPMERVS
MHV	CVSKVNVNVV DFKDFQFMLW CNDEKVMTEY PRLQAASDWK PGYSMPPLYK YLNSPMERVS
AIBV	NKSKVVTVSI DYHSINFMTW FEDGSIKTCY POLQS-AWT CGYAMPQIYK VQNCVMEPCN
SARS CoV	VISKVHEVII DYAEISFMLW CKDGHVETFY PKLQASQAWK PGYAMPQIYK MQRMCLPCN

	7085	7095	7105	7115	7125	7135
EMCR	LYNYGAGIKL	PSGIMLNVR	YTQLCQYLS	TTMCVPHNMR	VHLYGAGSDR	GVAPGTTVLK
229E	LYNYGAGIKL	PSGIMFNVR	YTQLCQYFNS	TTLCVPHNMR	VHLYGAGSDY	GVAPGTTVLK
PEDV	LYNYGAGVKL	PDGIMFNVR	YTQLCQYLS	TTMCVPHNMR	VHLYGAGSDR	GVAPGTTVLK
TGEV	LYNYGAGVKL	PDGITTNR	YTQLCQYLS	TTLCVPHNMR	VHLYGAGSDR	GVAPGTTVLK
OV43	LWNYGKPVTL	PTGCMNVAK	YTQLCQYLS	TTLCVPHNMR	VHLYGAGSEK	GVAPGSAVLR
BoCoV	LWNYGKPVTL	PTGCMNVAK	YTQLCQYLS	TTLCVPHNMR	VHLYGAGSEK	GVAPGSAVLR
MHV	LWNYGKPVTL	PTGCMNVAK	YTQLCQYLS	TTLCVPHNMR	VHLYGAGSDR	GVAPGSAVLR
AIBV	IPNYGVGTL	PSGIMNVAK	YTQLCQYLS	TTICVPHNMR	VHLYGAGSDR	GVAPGSAVLR
SARS CoV	LQNYGENAVI	PKGIMNVAK	YTQLCQYLS	LTLCVPHNMR	VHLYGAGSDR	GVAPGSAVLR

	7145	7155	7165	7175	7185	7195
EMCR	RWLPPD----	-----AIII	DNDINDVSD	ADFSITGDCA	TVYLEDKFDL	LISDMYDG--
229E	RWLPHD----	-----AIVV	DNDVVDVSD	ADFSITGDCA	TVYLEDKFDL	LISDMYDG--
PEDV	RWLPLD----	-----AIIV	DNDSDVDSD	ADFSITGDCA	TVYLEDKFDL	LISDMYDG--
TGEV	RWLPPD----	-----AIIV	DNDSDVDSD	ADFSITGDCA	TVYLEDKFDL	LISDMYDG--
OV43	QWLPAG----	-----TILV	DNDLYPFVSD	SVATYFGDCI	TLFPDQCQWL	IISDMYDP--
BoCoV	QWLPAGTILR	QWLPAGTILV	HNDLYPFVSD	SVATYFGDCI	TLFPDQCQWL	IISDMYDP--
MHV	QWLPAG----	-----SILV	DNDINPFVSD	SVASYGNCI	TLPIACQWDL	IISDMYDP--
AIBV	QWLPAG----	-----TLLV	DNDIVDVSD	AHVSVLSDCN	KYNTHEKFDL	VISDMYTDND
SARS CoV	QWLPAG----	-----TLLV	DNDIVDVSD	ADSTLIGDCA	TVHTANKWDL	IISDMYDP--

	7205	7215	7225	7235	7245	7255
EMCR	--RIKFCGGE	NVSKDGFFTY	LNGVIREKLA	IGGSVAIKIT	EYSWNKLYE	LIQRFATWTL
229E	--RTKAIDGE	NVSKDGFFTY	INGFICEKLA	IGGSVAIKIT	EYSWNKLYE	LIQRFATWTL
PEDV	--KIKSCDGE	NVSKDGFFTY	INGFICEKLA	IGGSVAIKIT	EYSWNKLYE	LIQRFATWTL
TGEV	--STKSIDGE	NTSKDGFFTY	INGFICEKLS	IGGSVAIKIT	EYSWNKLYE	LIQRFATWTL
OV43	--ITKNIGEY	NVSKDGFFTY	ICHMIRDKLA	IGGSVAIKIT	EYSWNAELK	LMGYFAFWTV
BoCoV	--LLLDIGVH	VVRCS--YI	HCHMIRDKLA	IGGSVAIKIT	EYSWNAELK	LMGYFAFWTV
MHV	--LTKNIGEY	NVSKDGFFTY	LCHLIRDKLA	IGGSVAIKIT	EYSWNAELK	LMGYFAFWTV
AIBV	SKRKHEGVIA	NNGNDVFIY	LSSFLRNLA	IGGSFAVKIT	ETSWHEVLYD	IAQDCAWWTM
SARS CoV	--RTKHVTKE	NDSKGFFTY	LCGFIKQKLA	IGGSVAIKIT	EHSWNADLYK	LMGHFSWWTA

	7265	7275	7285	7295	7305	7315
EMCR	FCTSVNTSSS	EAFLIGINYL	GDFIQGPFIA	GNTVHANYIF	WRNSTIMSLS	YNSVLDLSKF
229E	FCTSVNTSSS	EAFLIGINYL	GDFIQGPFID	GNTVHANYIF	WRNSTIMSLS	YNSVLDLSKF
PEDV	FCTSVNTSSS	EAFLIGINYL	GDFIQGPFID	GNTVHANYIF	WRNSTIMSLS	YNSVLDLSKF
TGEV	FCTSVNTSSS	EAFLIGINYL	GPYCDKAIVD	GNTVHANYIF	WRNSTIMSLS	YNSVLDLSKF
OV43	FCTSVNTSSS	EAFLIGINYL	GPYCDKAIVD	GNTVHANYIF	WRNSTIMSLS	YNSVLDLSKF
BoCoV	FCTSVNTSSS	EAFLIGINYL	GPYCDKAIVD	GNTVHANYIF	WRNSTIMSLS	YNSVLDLSKF
MHV	FCTSVNTSSS	EAFLIGINYL	GPYCDKAIVD	GNTVHANYIF	WRNSTIMSLS	YNSVLDLSKF
AIBV	FCTSVNTSSS	EAFLIGINYL	GPYCDKAIVD	GNTVHANYIF	WRNSTIMSLS	YNSVLDLSKF
SARS CoV	FCTSVNTSSS	EAFLIGINYL	GPYCDKAIVD	GNTVHANYIF	WRNSTIMSLS	YNSVLDLSKF

	7325	7335	7345	7355	7365
EMCR	ECKHKATVVV	TLKDSVDNDM	VLSLIKSGRL	LLRNSGRFGG	FSNHLVSTK-
229E	NCKHKATVVV	QLKDSINEM	VLSLRSGRL	LVRNGKCLS	FSNHLVSTK-
PEDV	NCKHKATVVV	NLKDSISDV	VLGLLKNGKL	LVRNDAICG	FSNHLVSTK-
TGEV	KCRNNALIV	NLKEKELNEM	VIGLLRKGL	LIRNNGKLLN	FGNHFVNT-
OV43	PLKLAGTAVI	NLRADQINDM	VYSLLEKGL	LIRDNTKEVF	VGDSLNVNVI-
BoCoV	EIPQFGTGVL	IACLIWLNRS	LSWLMP---	-----	-----
MHV	PLKVAGTAVV	SLKPDQINDL	VLSLIEKGL	LVRDTRKEVF	VGDSLNVNVI-
AIBV	DLRLKATPVV	NLKEKELNEM	VIGLLRKGL	LIRNNGKLLN	FGNHFVNT-
SARS CoV	PLKLRGTAVM	SLKENQINDM	IYSLLEKGL	IIRENNRVVV	SSDILVNN--

E. Putative Spike protein

	5	15	25	35	45	55
EMCR S	---MKLFLL	LLILP---	L VSCFSTC---	-----	N SNASIS---	-----ML
229E S	---	---	---	---	---	---
PEDV	MRSLLIYFWLL	LPVLP---	T LSLPQDV---	-----	T RCQSTTNF---	-----RRFFS
TGEV	---MKKLFVV	LVVMP---	L IYGNFP---	-----	C SKLTNRTIGN	QWNLIETFL
CaCoV	---MIVLTL	LFLFL-YSSV	SCTSNND---	-----	C VQVNVTLQPG	NENIIRDFLF
FeCoV	---MIVLVT	LLLCSYHTV	LSTTNNE---	-----	C IQVNVTLQAG	NENLIRDFLF
Por Resp C	---MKKLFVV	LVVMP---	L IYG---	-----	---	---
OC43	---MFLIL	LISLPTAFV	IGDLKCTSDT	SYINDKDTGP	PPISTDTVDV	TNGLGTYIVL
BoCoV	---MFLIL	LISLPTAFV	IGDLKCT--T	VSINDVDVTA	PSISTDIVDV	TNGLGTYIVL
MHV	---MLFVF	LTLPLSSGLY	IGDFRCIQ-L	VNTDTSNASE	PSVSTEVDV	SKGIGTYIVL
Rat CoV	---MLFVF	LTLPLSCLGY	IGDFRCIN-L	VNTRISNARA	PSVSTEVDV	SKGIGTYIVL
PHEV	---MFFIL	LISLPSAFV	IGDLKCT--T	SLINDVDVTV	PSISSEVDV	TNGLGTFYVL
AIBV	---	---	---	---	---	---
SARS	---MFIFLL	FLTLTSG---	SDLDR---	-----	-CTTFDDVQA	PNYTQHTSSM
	65	75	85	95	105	115
EMCR S	QLG--VPDNS	STIVTGLLP-	---VHWICAN	QSTSSYPANG	FFYIDVG-KH	RSAFALHSGY
229E S	---	---	---	---	---	---
PEDV	KFN--VQAPA	VVLGGYLP	MNSSSWYCGT	GIETASGVHG	IFLSYIDSGQ	GFEIGISQEP
TGEV	NYSSRLPNS	DVVLGDYFPT	--VQFWNCI	RNDSNOLYVT	LENLKALYWD	YATENITWN-
CaCoV	QN---FKEEG	SLVVGYYYP-	--TEVWYNC	TQQTAYKY	FSNIHAFYFD	MEAMENSTGN
FeCoV	SN---FKEEG	SVVVGYYYP-	--TEVWYNC	RTARTAFQY	FNNIHAFFYV	MEAMENSTGN
Por Resp C	---	---	---	---	---	---
OC43	DR---VYLNT	TFLNGYYPT	SGSTYRNMAL	RGSVLLSRLW	FKPPFLSDFI	NGIFAKVKNT
BoCoV	DR---VYLNT	TLLNGYYPT	SGSTYRNMAL	KGTLLLSRLW	FKPPFLSDFI	NGIFAKVKNT
MHV	DR---VYLNA	TLLTGYYPV	DGSMYRNMAL	TGINTISLW	YKPPFLSEFN	DGIFAKVKNL
Rat CoV	DR---VYLNA	TLLTGYYPV	DGSMYRNMAL	MGTNTLSLW	FEPPFLSEFN	DGIYARVKNL
PHEV	DR---VYLNT	TLLNGYYPT	SGATFRNMAL	KGTRLLSTLW	FKPPFLSPFN	DGIFAKVKNS
AIBV	---	---	---	---	---	---
SARS	RG---VYYPD	EIFRSDTLYL	TQDLFLFFYS	NVTGFHTINH	TFGNPVIPEK	DGIYFAATEK
	125	135	145	155	165	175
EMCR S	YDANQYIYL	TNKIH----	-----	LNAPVTLKIC	KFGN-----	---TSFDFLS
229E S	---	---	---	---	---	---
PEDV	FDPGQYQLYL	HKATNG----	-----	N TNAIARLRIC	QFPD-----	---KTLGPTVN
TGEV	-HRQLNVVV	NGYPYSITV-	-----	TTRN FNSAEGAIIC	ICKGSPPTTT	TESSLTCNWR
CaCoV	ARGKPLLVHV	HGNPVSIIIV	ISAYRDDVQF	RPLKHLGLLC	ITKN--DTVD	YNSFTTNQWR
FeCoV	ARGKPLLEHV	HGEPVSVII-	-SAYRDDVQ	RPLKHLGLVC	ITKN--RHIN	YEFTSNQWN
Por Resp C	---	---	---	---	---	---
OC43	KVIKDRVMYS	EFPAITIG--	-----	STF VNTSYSVVVQ	PRTINSTQDG	YNKLQGLLEV
BoCoV	KVIKGVVMYS	EFPAITIG--	-----	STF VNTSYSVVVQ	PHTTN-----	DNKLQGLLEI
MHV	KASLPKDSIS	YFPTIIIG--	-----	SNF VTTSYTVVLE	PYN-----	---GIIMA
Rat CoV	KASLPKDSAS	YFPTIIIG--	-----	SNF VNTSYTVVLE	PYN-----	---GIIMA
PHEV	RFSKDGVIYS	EFPAITIG--	-----	STF VNTSYSIVVE	PHTSL-----	NGNLQGLLQI
AIBV	---	---	---	---	---	---
SARS	SNVVRGWVFG	STMNKSQS-	-----	VII INNSTNVVIR	ACN-----	FEL CDPFFAVSK
	185	195	205	215	225	235
EMCR S	NVSTSHDCIV	NLSFTEQL--	GVPLGITISG	ETVRLHLYNA	TRTFYVPAAY	KLTKLSVKCY
229E S	---	---	---	---	---	---
PEDV	DVTTRGNCLF	NKAIAYMRD	GKDIVVGITW	DNDRTVVF-A	DKIYHFYLN	DWSRVATRCY
TGEV	SECR-LNHKF	PICPSNSEAN	CGNMLYGLQW	FADEVVAYLH	GASYRISFEN	QWSGTVTFGD
CaCoV	DICLGDDRKI	PFSVPTDN-	-GTKLFGLEW	NDDYVTAYIS	DESHRLNINN	NWFNNVTLLY
FeCoV	STCTGADRKI	PFSVIPTDN-	-GTKIYGLEW	NDDYVTAYIS	GRSYHLNINT	NWFNNVTLLY
Por Resp C	---	---	---	---	---	---
OC43	SVCQYNMCEY	PQTICHPNLG	--NHRKELWH	LDTGVSCLY	KRNFTYDVNA	DYLYFHFYQ-
BoCoV	SVCQYTMCEY	PHTICHPKLG	--NKRVELWH	WDTGVVSCLY	KRNFTYDVNA	DYLYFHFYQ-
MHV	SICQYTICQL	PYTDCPKNTG	G-NKLIGFWH	TEKSPVCIL	KRNFTFNVNA	EWLYFHFYQ-
Rat CoV	SICQYTICQL	PHTDCKPNTG	G-NKLIGFWH	TDLRPPVCIL	KRNFTFNVNA	EWLYFHFYQ-
PHEV	SVCQYTMCEY	PHTICHPNLG	--NQRIELWH	YDTPVVSCLY	KRNFTYDVNA	DYLYFHFYQ-
AIBV	---	---	---	---	---	---
SARS	PMGTQHTMI	FDNAFNCTFE	YISDAFSLDV	SE-KSGNFKH	LREFVFNKND	GFLYVYKG--

	245	255	265	275	285	295
EMCR S	FSESCVF---	-----SVVNA-	-T-ITVNVTT	LNGRIVNYTV	COD---CNGY	TDNIFSVQOD
229E S	-----	-----CQT	TNGLNTSYSV	CNG---CVGY	SENVFAVESG	
PEDV	NRRSCAM---	-----QYVYTP	TY-YMLNVTS	AGEDGIYYEP	CTAN---CTGY	AANVFATDSN
TGEV	MRATTLEVAG	TLVDLWVFN	VYDVSYYRVN	NKNGTTVVS	CTD---QCASY	VANVFTTQPG
CaCoV	SRTSTATWQH	S--AAYVYQG	VSNFTYYKLN	KTAGLKSVEL	CEDYEYCTGY	ATNVFAPTS
FeCoV	SRSSTATWEY	S--AAYAYQG	VSNFTYYKLN	NTNGLKTYEL	CEDYEHCTGY	ATNVFAPTS
Por Resp C	-----	-----	-----TSVVS	CTD---QCASY	VANVFTTLP	
OC43	EGG-----	-----TFYAYFTDT	GVVTKFLFNV	YLG---MALS	HYVVMPLTCN	
BoCoV	EGG-----	-----TFYAYFTDT	GVVTKFLFNV	YLG---TVLS	HYVVLPLTCS	
MHV	QGG-----	-----TFYAYYADV	SSATTFLFSS	YIG---DVL	QYFVLPYMC	
Rat CoV	QGG-----	-----TFYAYYADV	SSATTFLFSS	YIG---AVLT	QYFVLPYMC	
PHEV	EGG-----	-----TFYAYFTDT	GEVTKFLFNL	YLG---TVLS	HYVVMPLTCN	
AIBV	S-----	-----YVYYYQS	AFRPPSGWHL	QGG---AYAV	VNISSEFNNA	
SARS	YQP-----	-----IDVVRDLPSG	FNTLKPIFKL	PLG-INITNF	RAILTAFS	

	305	315	325	335	345	355
EMCR S	GRIPNGFPFN	NWFL-LTNGS	TLVDGVSRLY	QPLRLTCLWP	VPGLKSSSTG	VYFNATGSDV
229E S	GYIPSDFAFN	NWFL-LTNTS	SVVDGVVRSF	QPLLLNCLWS	VSGLRFTTGF	VYFNGTG-RG
PEDV	GHIPEGFSFN	NWFL-LSNDS	TLHLGKVVS	QPLLVNCLLA	IPKIYGLGQF	FSFNHTM-DG
TGEV	GFIPSDFSFN	NWFL-LTNSS	TLVSGKLVT	QPLLVNCLWP	VPSFEAAST	FCFEGAG-FD
CaCoV	GYIPDGFSFN	NWFL-LTNSS	TFVSGRFVTN	QPLLVNCLWP	VPSFGVAAQ	FCFEGAQ-FS
FeCoV	GYIPDGFSFN	NWFL-LTNSS	TFVSGRFVTN	QPLLVNCLWP	VPSFGVAAQ	FCFEGAQ-FS
Por Resp C	GFIPSDFSFN	NWFL-LTNSS	TLVNGKLVT	QPLLVNCLWP	VPSFEAAST	FCFEGAD-FD
OC43	SKVKNGTLE	YVVTPLTSRQ	YLLAFNQDGI	IFNAVDCMSD	FMSEIKCKTQ	SIAPPTG-VY
BoCoV	S-----	AMTLE	YVVTPLTSRQ	YLLAFNQDGI	IFNAVDCMSD	FMSEIKCKTQ
MHV	LTITGVFSQ	YVVTPLVSRQ	YLFNFNQGI	ITSVDCASS	YTSEIKCKTQ	SMNPNTG-VY
Rat CoV	PTTSVSSPQ	YVVTPLVSRQ	YLFNFNQGI	ITSVDCASS	YTSEIKCKTQ	SMNPNTG-VY
PHEV	S-----	ALSLE	YVVTPLTSRQ	YLLAFNQDGI	IFNAVDCMSD	FMSEIKCKTQ
AIBV	G-----	SSS	GCTVGIHGG	RVVNASSIAM	TAPSSGMAWS	SSQFCTAHN
SARS	QIOWGTSAAA	YFVGYLKPTT	FMLKYDENG	ITDAVDCSQN	PLAELKCSVK	SFEIDKG-IY

	365	375	385	395	405	415
EMCR S	NONGQHNSV	ADVRYNLNL	SANSVDNLKS	GVIVFKTLQY	-DVLFCYCN-	--SS-SGVLD
229E S	DCKGSSDVL	SDVIRYNLF	EEN---LRR	GTLFKTSYG	-VVVFCYCN-	--NT-LVSGD
PEDV	VNGAADVRA	PEALREIND	TSV---LAE	GSIVLHTAL	TNLSFVCSN-	--SSDPLAI
TGEV	QCNGAVLNNT	VDVIRENLF	TTNVQSGKA	TVFSLNTGG	VTLEISCY--	TVSDSSFFSY
CaCoV	QCNGAVLNNT	VDVIRENLF	TTNVQSGKA	TVFSLNTGG	VTLEISCYND	TVSESSFFSY
FeCoV	QCNGAVLNNT	VDVIRENLF	TTNVQSGKA	TVFSLNTGG	VTLEISCYSD	TVSESSFFSY
Por Resp C	QCNGAVLNNT	VDVIRENLF	TTNVQSGKA	TVFSLNTGG	VTLEISCYND	TVSDSSFFSY
OC43	ELNGYTVQPI	ADVRRKLN	PNCNIEAWLN	DKSVPSPLNW	ERKTFSCNF	NMSSLMSFIQ
BoCoV	ELNGYTVQPI	ADVRRKLN	PNCNIEAWLN	DKSVPSPLNW	ERKTFSCNF	NMSSLMSFIQ
MHV	DLSGYTVQPV	GLVYRRVNL	PDCKIEEWT	AKSVPSPLNW	ERKTFQCNF	DLSSLLRFVQ
Rat CoV	DLSGYTVQPV	GLVYRRVNL	PDCKIEEWT	AKSVPSPLNW	ERKTFQCNF	DLSSLLRFVQ
PHEV	ELNGYTVQPV	ATVYRRPDL	PNCNIEAWLN	SKTVSSPLNW	ERKTFSCNF	NMSSLMSFIQ
AIBV	CYKHGGCPLT	GMLQONLIRV	SAMKNGQLFY	NLTVSVAKYP	TFRSFQCNV-	--NLTSVYLN
SARS	QTSNFRVVP	GDVRFPPNIT	NLCPFGEVEN	ATKFPSPYAW	ERKKISNCVA	DYSVLVNSTF

	425	435	445	455	465	475
EMCR S	TTIPFGPSSQ	PYYCFINSTI	NTTHVSTFVG	ILPPTVREIV	VARTGQFYIN	GFKYFDLGI
229E S	AHIPGTGLG	NFYCFVNTTI	GNETTSAFVG	ALPKTVREFV	ISRTGHFYIN	GKRYFTLGNV
PEDV	FAIPGATEV	PYYCFKVDOT	YNSTVYKFLA	VLPPTVREIV	ITKYGDVYVN	GFGYLHLGLL
TGEV	GEIPFGVTG	PRYCYV---L	YNGTALKYLG	TLPPSVKEIA	ISKWGHFYIN	GYNFFSTFPI
CaCoV	GEIPFGVTG	PRYCYV---L	YNGTALKYLG	TLPPSVKEIA	ISKWGHFYIN	GYNFFSTFPI
FeCoV	GEIPFGVTG	PRYCYV---L	YNGTALKYLG	TLPPSVKEIA	ISKWGHFYIN	GYNFFSTFPI
Por Resp C	GEIPFGVTG	PRYCYV---L	YNGTALKYLG	TLPPSVKEIA	ISKWGHFYIN	GYNFFSTFPI
OC43	ADSFCTNNID	AAKIYG--MC	FSSITIDKFA	IPNGRKVDLQ	LGNLGYLQSF	NYRIOTTTATS
BoCoV	ADSFCTNNID	AAKIYG--MC	FSSITIDKFA	IPNGRKVDLQ	LGNLGYLQSF	NYRIOTTTATS
MHV	AESLSCSNID	ASKVYG--MC	FGSISIDKFA	IPNSRRVDLQ	LGKSGLLQSF	NYKIDTRATS
Rat CoV	AESLSCSNID	ASKVYG--MC	FGSISIDKFA	IPNSRRVDLQ	LGKSGLLQSF	NYKIDTRATS
PHEV	ADSFCTNNID	ASRLYG--MC	FGSITIDKFA	IPNSRKVDLQ	VGKSGYLQSF	NYKIDTAVSS
AIBV	GDVLTSTNET	IDVTSAG--V	YFRAGGPITY	KVMREVKALA	YFVNGTAQDV	ILCDGSPRGL
SARS	FSTFCYGV	ATKLND--LC	FSNVYADSEV	VKGDDVRQIA	PGQTGVIAIDY	NYKLPPDDFMG

	485	495	505	515	525	535
EMCR S	EAVNFNVT--	--TASATDFW	TVAFATFVDV	LVNVSATNIQ	NLLYCDSPFE	KLQCEHLQFG
229E S	EAVNFNVT--	--TAETTDFC	TVALASYADV	LVNVQSITSIA	NIIYCNSVIN	RLRCDQLSFD
PEDV	DAVINFTFGH	GTDDVSGFW	TIASTNFVDA	LIEVQGTISI	RILYCDOPVS	QLKCSQVAFD
TGEV	DCISFNLT--	--TGSDVFW	TIAYTSYTEA	LVQVENTAIT	KVTYCNSHVN	NIKCSQITAN
CaCoV	DCISFNLT--	--TGSDVFW	TIAYTSYTEA	LVQVENTAIT	KVTYCNSHVN	NIKCSQITAN
FeCoV	DCISFNLT--	--TGSDVFW	TIAYTSYTEA	LVQVENTAIT	KVTYCNSHVN	NIKCSQITAN
Por Resp C	DCISFNLT--	--TGSDVFW	TIAYTSYTEA	LVQVENTAIT	KVTYCNSHVN	NIKCSQITAN
OC43	COLYNNLP--	--AANVSVS	RFPSTWNKR	EGFIEDSVFK	PRPAGVLTNH	DVYVYQHCFK
BoCoV	COLYNNLP--	--AANVSVS	RFPSTWNKR	EGFIEDSVFK	PRPAGVLTNH	DVYVYQHCFK
MHV	COLYNNLP--	--AANVSVS	RFPSTWNKR	EGFIEDSVFK	PRPAGVLTNH	DVYVYQHCFK
Rat CoV	COLYNNLP--	--AANVSVS	RFPSTWNKR	EGFIEDSVFK	PRPAGVLTNH	DVYVYQHCFK
PHEV	COLYNNLP--	--AANVSVS	RFPSTWNKR	EGFIEDSVFK	PRPAGVLTNH	DVYVYQHCFK
AIBV	LACQNTG--	--NFSGDFY	PFTNSSLVKQ	KFIVYR--	---ENSNT	TCTLHNFIFH
SARS	CVLAWNTR--	--NID	ATSTGMYNYK	YRILR--	---HG--	-----

	545 555 565 575 585 595
EMCR S	LQDGFY--SA --NFLDDNVL P-----ET YVALPIYYQH TDINFATA-- --SFGGSCYV
229E S	VPDGFY--ST --SPIQSVEL P-----VS IVSLPVYHKH TFIVLYVDFK PQSGGGKCFN
PEDV	LDDGFYPISS --RNLLSHEQ P-----IS FVTLPSFNH SFVNITVSA-- --AFGG-LSS
TGEV	LNNGFYPVSS --SEVG--LV N-----KS VVLLPSFYTH TIVNITIGLG --MKRSGYGQP
CaCoV	LQNGFYPVAS --SEVG--LV N-----KS VVLLPSFYSH TSVNITIDLG --MKRS-VTVT
FeCoV	LNNGFYPVAS --SEVG--FV N-----KS VVLLPSFETY TAVNITIDLG --MKLSGYGQP
Por Resp C	LNNGFYPVSS --SEVG--SV N-----KS VVLLPSFLTH TIVNITIGLG --MKRSGYGQP
OC43	APKNFCPCKL NGS-CVSGSP G-----KNNG IGTCPAGTNY LTCDN----- --LC
BoCoV	APKNFCPCKL DGSCLVGNP GIDAGYKNSG IGTCPAGTNY LTCHNAA----- --QCDCLC
MHV	VGASYCPCAN P-SIVSPCTT G-----K-PN FANCPTGTSN RECTVMPLAN --NQFKCDCTC
Rat CoV	VGASYCPCAK P-STVYSCVT G-----K-PK SANCPTGTSN RECNAVQASG-- --FKSKDCTC
PHEV	TPNTYCPCRT --SQCIG-- G-----AG TGTCPVGTTV RKCFAAVTK-- --ATKCTCWC
AIBV	NETGANPNPS -----G VQNIQTYQTK TAQSGYYNFN -----FSF
SARS	--KLRPFER -----D ISNVFFSPDG KPCTP-----

	605 615 625 635 645 655
EMCR S	CKPRQVNISL N----GNTSV CVRTSHFSIR YIYNRVKSGS P-----G DSSWHIYLKS
229E S	CYPAGVNITL ANFNETKGPL CVDTSHTTK YVAVYANVG----- --RWSASINT
PEDV	ANLVASDTTI N----GFSSF CVDTRQFTIT LFYNVTNSYG----- --YVSKSQD
TGEV	IASTLSNITL PMQDHNTDVY CIRSQQFSVY VHSTCKSALW DNIFKRNCCTD VLDATAVIRT
CaCoV	IASPLSNITL PMQDNNDVY CIRSQQFSVY VHSTCKSSLW DNNFNSACTD VLDATAVIRT
FeCoV	IASTLSNITL PMQDNNDVY CIRSQQFSVY VHSTCKSSLW DNIFNQDCTD VLEATAVIRT
Por Resp C	IASTLSNITL PMQDNNDVY CVRSQQFSVY VHSTCKSVLW DNVFKRNCCTD VLDATAVIRT
OC43	TPDPITFKAT GTYKCPQTKS LVGIGEHCSG LAVKSDYCGG-----N SCTCRPQAFI
BoCoV	TPDPITSKST GPYKCPQTKY LVGIGEHCSG LAIKSDYCGG-----N PCTCQPQAFI
MHV	NPSPLTTYDL --R-CLQARS MLGVGDHCEG LGVLEDKCGG S-----N TCNCSAHAFV
Rat CoV	NPSPLTTYDP --R-CLQARS MLGVGDHCEG LGVLEDKCGG S-----N ICNCSADAFV
PHEV	QPDPSYKGV NAWTCPSQKV SIQPGQHCPG LGLVEDDCSG-----N PCTCKPQAFI
AIBV	LSSFVYKESN FMYGSYHPSC KFRLETINNG LWFNSLSVS----- --IAYGPLQ
SARS	-----P--AL NCYWPLNDY-----G----- --FYTTTGI

	665 675 685 695 705 715
EMCR S	GTCPFSSFKL NNFQKFKTIC FSTVEVPGSC NFPLEATW-- HYTSYTVIGA LYVTWSEGNS
229E S	GNCFPSFGKV NNFVKFGSVC FSLKDIPGGC AMPIVANW-- AYSKYTTIGS LYVSWSDGOG
PEDV	SNCPFTLQSV NDYLSFSKFC VSTSLLAGAC TIDLFYGP-- AFGSGVKLTS LYFQFTKGEL
TGEV	GTCPFSSFDKL NNYLTFNKFC LSLSPVGANC KFDVAAR-- TRTNEQVVRS LYVIIEEGON
CaCoV	GTCPFSSFDKL NNYLTFNKFC LSLNPVGANC KLDVAAR-- TRTNEQVFGS LYVIIEEGON
FeCoV	GTCPFSSFDKL NNYLTFNKFC LSLSPVGANC KFDVAAR-- TRTNEQVVRS LYVIIEEGON
Por Resp C	GTCPFSSFDKL NNYLTFNKFC LSLSPVGANC KFDVAAR-- TRTNDQVVRS LYVIIEEGNS
OC43	GWSADSCLOQ DKCNIFANFI LHDVNSGLTC STDLOKANTD IILGVCVNYD LYGILGQGIF
BoCoV	GWSVDSCLQG DRCNIFANFI FHDVNSGTTT STDLOKSNTD IILGVCVNYD LYGITGGQIF
MHV	GWAKDSCLAN GRCHIFSCLM LNGINSGTTT SMDLQLPNTE VVTGVCVKYD LYGITGGQIF
Rat CoV	GWAMDSCLSN ARCHIFSCLM LNGINSGTTT STDLOLPNTE VVTGVCVKYD LYGSTGGQVF
PHEV	GWSETCLQN GRCNIFANFI LNDVNSGTTT STDLOQGNIT ITTDVCVNYD LYGITGGQIL
AIBV	GGCKPSVFKG RATCCYAYS YGGPSLCKGVY SGELDHN-- --FECGLLV YVTKSGGSRI
SARS	GYQYRVVVVL S----FELLN APATVCGPKL STDLIKN-- --QCVNFN FNELTGTG-V

	725 735 745 755 765 775
EMCR S	ITGVPPVPSG IREFSNLVLN NCTKYNIYDY VGTGIIRSSN QSLAGGITYV S-----
229E S	ITGVPPQVEG VSEFMNVTLD KCTKYNIYDV SGVGVIRVSN DTFLNGITYT S-----
PEDV	ITGTPKPLEG ITDVSFMTLD VCTKYTIYGF KEGEITLTN SSILAGVYIT S-----
TGEV	IVGVPSDMSG VHDLSVLHLD SCTDYNIIYGR TGVGIIRQTN RTLLSGLYYT S-----
CaCoV	IVGVPSDMSG LHDLSVLHLD SCTDYNIIYGR TGVGIIRKTN STLLSGLYYT S-----
FeCoV	IVGVPSDMSG LHDLSVLHLD SCTDYNIIYGR TGVGIIRRTN STLLSGLYYT S-----
Por Resp C	IVGVPSDMSG LHDLSVLHLD SCTDYNIIYGR TGVGIIRQTN RTILSGLYYT S-----
OC43	VEVNATYYNS WQNLLYDSNG NLYGFRDYIT NRTFMIRSCY SGRVSAAFHA N-----
BoCoV	VEVNATYYNS WQNLLYDSNG NLYGFRDYIT NRTFMIRSCY SGRVSAAFHA N-----
MHV	KEVKADYYNS WQNLLYDVNG NLIGFRDFVA NKSYTIRSCY SGRVSAAYHQ D-----
Rat CoV	KEVKADYYNS WQNLLYDVNG NLNGFRDIYT NKTYLLRSCY SGRVSAAYHQ D-----
PHEV	IEVNATYYNS WQNLLYDSNG NLYGFRDYLS NRTFLIRSCY SGRVSAVFAH N-----
AIBV	QTATEPPVIT QNNYNNITLN TCVDYNIYGR TGQGFITNVT DSAVSYNYLA DAGLAILDTS
SARS	LTPSSKRFPQ FQQFGRDVSD FTDSVRDPKT SEILDISPCS FGGSVVITPG TN-----A

	785 795 805 815 825 835
EMCR S	NSGNLLGFKN VSTGNI FIVT PCNQPDQAV YQQ-SIIGAM TAVNESRYGL QNLLQLPNEY
229E S	TSGNLLGFKD VTKGTIYSIT PCNPPDQLVV YQQ-AVVGAM LSENFYSYGF SNVVELPKFF
PEDV	DSGQLLAFKN VTSAGVYSVT PCSFSEQAAY VND-DIVGVI SSLSNS--TF NNTRELPGFF
TGEV	LSGDLGFKN VSDGVIYSVT PCDVSAQAAV IDG-TIVGAI TSINSELLGL THWTTTPNFY
CaCoV	LSGDLGFKN VSDGVVYSVT PCDVSAQAAV IDG-AIVGAM TSINSELLGL THWTTTPNFY
FeCoV	LSGDLGFKN VSDGVIYSVT PCDVSAQAAV IDG-AIVGAM TSINSELLGL THWTTTPNFY
Por Resp C	LSGDLGFTN VSDGVIYSVT PCDVSAQAAI IDG-TIVGAI TSINSELLGL THWTTTPNFY
OC43	SSEPALLFRN IKCNVFNNS LTRQLQPINY FDS-YLGCVV NAYNSTAISV QTCDLTVGSG
BoCoV	SSEPALLFRN IKCNVFNNS LSRQLQPINY FDS-YLGCVV NADNSTSSVV QTCDLTVGSG
MHV	APEPALLYRN LKCDYVFNNN ISREETPLNY FDS-YLGCVV NADNSTEEAV DACDLRMGSG
Rat CoV	APEPALLYRN LKCDYVFNNN ISREETPLNY FDS-YLGCVI NADNSTEQSV DACDLRMGSG
PHEV	SSEPALLFRN LKSHVFNNN ILRQLQLVNY FDS-YLGCVV NAYNNTASAV STCDLTVGSG
AIBV	GSIDIFVQGG EYGLNYYKVN PCEDVNQGFV VSGGKLVGIL TSRNETGSOL LENQFYIKIT
SARS	SSEVAVLYQD VNCTDVSTAI HADQLTPAWR IYS-TGNVNF QTQAGCLIGA EHVDTSYECD

	845	855	865	875	885	895
EMCR S	YVS-----NG	GNN-----	-----CTTAV	MIYSNFGICA	DGSLIPVRPR	NSSDNGISAI
229E S	YAS-----NG	TYN-----	-----CTDAV	LTYSSEFGVCA	DGSIIAVQPR	NVSYDSVSAI
PEDV	YHS-----ND	GSN-----	-----CTEPV	LVYSNIGVCK	SGSIGYV-PS	QYGVQVRIAPT
TGEV	YYSI---YNY	TNDKTRGTAI	DSNDVDCEPV	ITYSNIGVCK	NGAFVFIN-V	THSDGDVQPI
CaCoV	YYSI---YNY	TNMNRGTAI	D-NDIDCEPI	ITYSNIGVCK	NGALVFIN-V	THSDGDVQPI
FeCoV	YYSI---YNY	TSERTRGTAI	DSNDVDCEPV	ITYSNIGVCK	NGALVFIN-V	THSDGDVQPI
Por Resp C	YYSI---YNY	TNDKTRGTPI	GSNDVDCEPV	ITYSNIGVCK	NGALVFIN-V	THSDGDVQPI
OC43	YCVD---YSK	NRR-----	-----SRGAI	TTGYRFTNFE	PFTVNSVN--	---DSLEPVG
BoCoV	YCVD---YST	KRR-----	-----SRRAI	TTGYRFTNFE	PFTVNSVN--	---DSLEPVG
MHV	LCVN---YST	SHR-----	-----ARSSV	STGYKLTTFE	PFTVRIVN--	---DSVESVD
Rat CoV	LCVN---YSI	AHR-----	-----ARRSV	STGYKLTTFE	PFTVSIVN--	---DSVESVG
PHEV	YCVD---YVT	ALR-----	-----SRRSF	TTGYRFTNFE	PFAANLVN--	---DSIEPVG
AIBV	NGTRFRRSI	TEN-----	-----VANCY	VSYGKFCIKP	DGSIATIVPK	QLEQFVAPLF
SARS	IPIG---AGI	CAS-----	-----YHTVSL	LRSTSQKSIV	AYTMSLG---	---ADSSIAY
	905	915	925	935	945	955
EMCR S	-ITANLSIPS	NWTTSVQVEY	LQITSTPIVV	DCATYVCNGN	PRCKNLLKQY	TSACKTIEDA
229E S	-VTANLSIPS	NWTTSVQVEY	LQITSTPIVV	DCSTYVCNGN	VRCEVELLKQY	TSACKTIEDA
PEDV	-VTGNISIPT	NFSMSIRTEY	LQLYNTPVSV	DCATYVCNGN	SRCKQLLTQY	TAACKTIESA
TGEV	-STGNVTIPT	NFTISVQVEY	IQVYTPVSI	DCSRYVCNGN	PRCKNLLTQY	VSACQTIEQA
CaCoV	-STGNVTIPT	NFTISVQVEY	IQVYTPVSI	DCARYVCNGN	PRCKNLLTQY	VSACQTIEQA
FeCoV	-STGNVTIPT	NFTISVQVEY	MQVYTPVSI	DCARYVCNGN	PRCKNLLTQY	VSACQTIEQA
Por Resp C	-STGNVTIPT	NFTISVQVEY	IQVYTPVSI	DCSRYVCNGN	PRCKNLLTQY	VSACQTIEQA
OC43	-GLYEIQIPS	EFTIGNMEEF	IQTSSPKVTI	DCAAFVCGDY	AACKSQLVEY	GSFCDNINAI
BoCoV	-GLYEIQIPS	EFTIGNMEEF	IQTSSPKVTI	DCAAFVCGDY	AACKSQLVEY	GSFCDNINAI
MHV	-GLYELQIPT	NFTIASHQEF	VQTRSPPKVTI	DCAAFVCGGH	TACRQQLVEY	GSFCDNINAI
Rat CoV	-GLYEMQIPT	NFTIASHQEF	IQTRSPPKVTI	DCAAFVCGDY	TACRQQLVDY	GSFCDNINAI
PHEV	-GLYEIQIPS	EFTIGNLEEF	IQTRSPPKVTI	DCATFVCGDY	AACRQQLAEY	GSFCENINAI
AIBV	NVTENVLIPN	SFNLTVTDEY	IQTRMDKVQI	NCLQYVCGSS	LDCRKLFOQY	GPVCDNILSV
SARS	-SNNTIAIPT	NFSISITTEV	MPVSMARKTSV	DCNMYICGDS	TECANLLLOQY	GSFCTQLNRA
	965	975	985	995	1005	1015
EMCR S	LRLSAHLETN	DVSSMLTFDS	NA-FSLANVT	SFG-----D	YNLSSVLPQ-	-----
229E S	LRNSARLESA	DVSEMLTFDR	KA-FTLANVS	SFG-----D	YNLSSVIPS-	-----
PEDV	LQLSARLESV	EVNSMLTISE	EA-LQLATIS	SFNG-----DG	YNFTNVLGAS	-----
TGEV	LAMGARLENM	EVDSMLFVSE	NA-LKLASVE	AFN-----SS	ETLDPIYKEW	PNIGGSWLEG
CaCoV	LAMGARLENM	EIDSMLFVSE	NA-LKLASVE	AFN-----ST	ENLDPIYKEW	PNIGGSWLEG
FeCoV	LAMGARLENM	EVDSMLFVSE	NA-LKLASVE	AFN-----ST	ENLDPIYKEW	PSIGGSWLEG
Por Resp C	LAMGARLENM	EVDSMLFVSE	NA-LKLASVE	AFN-----SS	ETLDPIYKEW	PNIGGSWLEG
OC43	LTEVNELLDT	TOLQVANSML	NG-VTLSTKL	KDGVNFNVD	INFSPVLGCL	G-----
BoCoV	LTEVNELLDT	TOLQVANSML	NG-VTLSTKL	KDGVNFNVD	INFSPVLGCL	G-----
MHV	LGEVNNLIDT	MQLQVASALI	QG-VTLSSRL	SDGIGGQIDD	INFSPLLGCL	G-----
Rat CoV	LGEVNNLIDT	MQLQVASALI	QG-VTLSSRL	ADGIGGQIDD	INFSPLLGCL	G-----
PHEV	LTEVNELLDT	TOLQVANSML	NG-VTLSTKI	KDGINFNVD	INFSPVLGCL	G-----
AIBV	VNSVGQKEDM	ELLNFYSSTK	PAGFNTPVLS	NVSTG-----E	FNISLLLTN-	-----
SARS	LSGIAAEQDR	NTRVFAQVK	QM-YKPTLK	YFG-----G	FNFSQILPDP	-----
	1025	1035	1045	1055	1065	1075
EMCR S	---RNIHSS	RIAGRSALED	LLFSKVVTSG	LGTVDVDYKS	CTKGLS--IA	DLACAQYNG
229E S	---LPTSGS	RVAGRSAIED	ILFSKLVTS	LGTVDADYKK	CTKGLS--IA	DLACAQYNG
PEDV	V---YDPASGR	VQKRSVIED	LLFNKVVTNG	LGTVDVDEYKR	CSNGRS--VA	DLVCAQYNG
TGEV	LKYILPSHNS	KRYRSIAIED	LLFDKVVTSG	LGTVDVDEYKR	CTGGYD--IA	DLVCAQYNG
CaCoV	LKDILPSHNS	KRYRSIAIED	LLFDKVVTSG	LGTVDVDEYKR	SAGGYD--IA	DLVCARYNG
FeCoV	LKDILPSHNS	KRYRSIAIED	LLFDKVVTSG	LGTVDVDEYKR	CTGGYD--IA	DLVCAQYNG
Por Resp C	LKYILPSDNS	KRYRSIAIED	LLFSKVVTSG	LGTVDVDEYKR	CTGGYD--IA	DLVCAQYNG
OC43	-SECSKASS-	---RSAIED	LLFDKVKLSD	VG-FVEAYNN	CTGGAE--IR	DLICVQSYNG
BoCoV	-SACNKVSS-	---RSAIED	LLFSKVKLSD	VG-FVEAYNN	CTGGAE--IR	DLICVQSYNG
MHV	-SDCSEGTMA	AQTGRSAIED	VLFDKVKLSD	VG-FVEAYNN	CTGGQE--VR	DLICVQSFNG
Rat CoV	-SDCSEGTMA	AQ-GRSAIED	VLFDKVKLSD	VG-FVESYNN	CTGGQE--VR	DLICVQSFNG
PHEV	-SECNRAST-	---RSAIED	LLFDKVKLSD	VG-FVQAYNN	CTGGAE--IR	DLICVQSYNG
AIBV	-----PSSRR	K---RSLIED	LLFSTVESVG	LP-TNDAYKN	CTAGPLGFFK	DLACAREYNG
SARS	-----LKPTK-	---RSFIED	LLFNKVTLAD	AG-FMKQYGE	CLGDIN--AR	DLICAQKFNG
	1085	1095	1105	1115	1125	1135
EMCR S	IMVLPGVADA	ERMAMYTGS	IGGMVLGGLT	S-----AAAI	FSLALQARLN	YVALQTDVLQ
229E S	IMVLPGVADA	ERMAMYTGS	IGGIALGGLT	S-----AVSIP	FSLALQARLN	YVALQTDVLQ
PEDV	IMVLPGVADA	EKLHMYASL	IGGMALGGIT	A-----AAALP	FSAVAVQARLN	YVALQTDVLQ
TGEV	IMVLPGVANA	DKMTMYTASL	AGGITLGA	GG-----AVAI	FSAVAVQARLN	YVALQTDVLN
CaCoV	IMVLPGVAND	DKMTMYTASL	TGGITLGA	GG-----AVAI	FSAVAVQARLN	YVALQTDVLN
FeCoV	IMVLPGVANA	DKMTMYTASL	AGGITLGA	GG-----AVAI	FSAVAVQARLN	YVALQTDVLN
Por Resp C	IMVLPGVANA	DKMTMYTASL	AGGITLGA	GG-----AVAI	FSAVAVQARLN	YVALQTDVLN
OC43	IKVLPPLLSE	NQISGYTLAA	TSASLFPLWT	A-----AAGVP	FYLNQYRIN	GLGVTMDVLS
BoCoV	IKVLPPLLSE	NQISGYTLAA	TSASLFPLS	A-----AVGVP	FYLNQYRIN	GLGVTMDVLS
MHV	IKVLPPLLSE	NQISGYTAGA	TASAMFPWS	A-----AAGVP	FSLSVQYRIN	GLGVTMDVLS
Rat CoV	IKVLPPLLSE	NQISGYTAGA	TASAMFPWS	A-----AAGVP	FALSVQYRIN	GLGVTMDVLS
PHEV	IKVLPPLLSE	NQISGYTLAA	TAASLFPPWT	A-----AAGVP	FYLNQYRIN	GLGVTMDVLS
AIBV	LLVLPPIITA	EMQALYTSSL	VASMAFGGIT	A-----AGAIP	FATQLOARIN	HLGITQSLLL
SARS	LTVLPPLLTD	DMIAAYTAAL	VSGTATAGWT	FGAGAAQIP	FAMQAYRIN	GIGVTQNVLY

	1145	1155	1165	1175	1185	1195
EMCR S	ENQKILASAF	NKAINNIVAS	FSSVNDIAITH	TAEAIHTVTI	ALNKIQDVVN	QOGSALNHLT
229E S	ENQKILASAF	NKAMTNIVDA	FTGVNDIAITQ	TSQALQTVAT	ALNKIQDVVN	QOGSALNHLT
PEDV	RNQQILASAF	NSAIGNITSA	FESVKEAISQ	TSKGLNTVAH	ALTKVQEVVN	QOGSALNHLT
TGEV	KNQQILASAF	NQAIGNITQS	FGKVNDIAIHQ	TSRGLATVAK	ALAKVQDVVN	IQGQALSHLT
CaCoV	KNQQILANAF	NQAIGNITQA	FGKVNDIAIHQ	TSRGLATVAK	ALAKVQDVVN	TQGQALSHLT
FeCoV	KNQQILANAF	NQAIGNITQA	FGKVNDIAIHQ	TSQGLATVAK	ALAKVQDVVN	TQGQALSHLT
Por Resp C	KNQQILASAF	NQAIGNITQS	FGKVNDIAIHQ	TSRGLTTVAK	ALAKVQDVVN	TQGQALRHLT
OC43	QNQKLIANAF	NNALYAIQEG	FDATN-----	-----S	ALVKIQAVVN	ANAEALNNLL
BoCoV	QNQKLIANAF	NNALDAIQEG	FDATN-----	-----S	ALVKIQAVVN	ANAEALNNLL
MHV	ENQKMIASAF	NNAIGAIQEG	FAATN-----	-----S	ALAKMQFVVN	ANAEALNNLL
Rat CoV	ENQKMIASAF	NNAIGAIQEG	FDATN-----	-----S	ALAKIQSVVN	ANAEALNNLL
PHEV	QNQKLIASAF	NNALDAIQEG	FDATN-----	-----S	ALVKIQAVVN	ANAEALNNLL
AIBV	KNQEKIASAF	NKAIGHMQEG	FRSTS-----	-----L	ALQIQDVVS	QQSAILTETM
SARS	ENQKQIANQF	NKASIQIQES	LTTTS-----	-----T	ALGKLQDVVN	QNAQALNTLV

	1205	1215	1225	1235	1245	1255
EMCR S	SQLRHNFQAI	SNSIHAIYDR	LDSIQADQVQ	DRLITGRLLA	LNAFVSQVLN	KYTEVRGSR
229E S	SQLRHNFQAI	SSSIQAIYDR	LDTIQADQVQ	DRLITGRLLA	LNVFVSHTLT	KYTEVRASRQ
PEDV	VQLQHNFQAI	SSSIDDIYSR	LDILSADVQV	DRLITGRLLA	LNAFVAQTLT	KYTEVQASRK
TGEV	VQLQNNFQAI	SSSIDDIYNR	LDELSADAQV	DRLITGRLLA	LNAFVSQTLT	RQAEVRSRQ
CaCoV	VQLQNNFQAI	SSSIDDIYNR	LDELSADAQV	DRLITGRLLA	LNAFVSQTLT	RQAEVRSRQ
FeCoV	VQLQNNFQAI	SSSIDDIYNR	LDELSADAQV	DRLITGRLLA	LNAFVSQTLT	RQAEVRSRQ
Por Resp C	VQLQNNFQAI	SSSIDDIYNR	LDELSADAQV	DRLITGRLLA	LNAFVSQTLT	RQAEVRSRQ
OC43	QQLSNRFGAI	SASLQEILSR	LDALAEQAQI	DRLINGRLTA	LNAVVSQQLS	DSTLVKFSAA
BoCoV	QQLSNRFGAI	SASLQEILSR	LDALAEQAQI	DRLINGRLTA	LNAVVSQQLS	DSTLVKFSAA
MHV	QQLSNRFGAI	SASLQEILSR	LDALAEQAQI	DRLINGRLTA	LNAVVSQQLS	DMTLVKVSAA
Rat CoV	QQLSNRFGAI	SASLQEILSR	LDALAEQAQI	DRLINGRLTA	LNAVVSQQLS	DMTLVKVSAA
PHEV	QQLSNRFGAI	SASLQEILSR	LDALAEQAQI	DRLINGRLTA	LNAVVSQQLS	DSTLVKFSAA
AIBV	ASLKNKFGAI	SSVIQEIYQ	FDALQANAQV	DRLITGRLLS	LSVLASAKQA	EYIRVVSQRE
SARS	KQLSSNFGAI	SSVNDILSR	LDKVEAEVQI	DRLITGRLLS	LQTVYVQQLI	RAAEIRASAN

	1265	1275	1285	1295	1305	1315
EMCR S	LAQKINECV	KSQSNRYGFC	G-NGTHIFSI	VNSAPDGLLF	LHTVLLPTDY	KNVKAWSGIC
229E S	LAQKINECV	KSQSKRYGFC	G-NGTHIFSI	VNAAPEGLVF	LHTVLLPTQY	KDVEAWSGLC
PEDV	LAQKINECV	KSQSQRYGFC	GGDGEHIFSL	VQAAPOGLLF	LHTVLLVPGDF	VNVLAIAGLC
TGEV	LAKDKVNECV	RSQSQRYGFC	G-NGTHLFSL	ANAAAPNGMIF	FHTVLLPTAY	ETVTAWPGIC
CaCoV	LAKDKVNECV	RSQSQRYGFC	G-NGTHLFSL	ANAAAPNGMIF	FHTVLLPTAY	ETVTAWSGIC
FeCoV	LAKDKVNECV	RSQSQRYGFC	G-NGTHLFSL	ANAAAPNGMIF	FHTVLLPTAY	ETVTAWSGIC
Por Resp C	LAKDKVNECV	RSQSQRYGFC	G-NGTHLFSL	ANAAAPNGMIF	FHTVLLPTAY	ETVTAWSGIC
OC43	QAMEKVNECV	KSQSSRINFC	G-NGNHIIISL	VQNPAPYGLYF	IHFVSYPPTY	VTARVSPGLC
BoCoV	QAMEKVNECV	KSQSSRINFC	G-NGNHIIISL	VQNPAPYGLYF	IHFVSYPPTY	VTARVSPGLC
MHV	QATEKVNECV	KSQSSRINFC	G-NGNHIIISL	VQNPAPYGLYF	IHFVSYPPTY	TTANVSPGLC
Rat CoV	QATEKVNECV	KSQSSRINFC	G-NGNHIIISL	VQNPAPYGLYF	IHFVSYPPTY	TTANVSPGLC
PHEV	QATEKVNECV	KSQSSRINFC	G-NGNHIIISL	VQNPAPYGLYF	IHFVSYPPTY	VTARVSPGLC
AIBV	LATQKINECV	KSQSIYRSGC	G-NGRHVLT	PQNPAPGIVF	IHFVSYPPTY	VNVTAIVGFC
SARS	LAATKMSECV	LGQSKRVDFC	G-KGYHLMSE	PQAPPHGVVF	LHVTYVPSQE	RNFTTAPAI

	1325	1335	1345	1355	1365	1375
EMCR S	VDG-----IYG	YVLQPNLVL	YS-----DN	GVFRVTSRVM	FQPRLPVLS	FVQIYNCNVT
229E S	VDG-----TNG	YVLQPNLAL	YK-----EG	NYRITSRIM	FEPRITPMAD	FVQIYNCNVT
PEDV	VNG-----EIA	LTLPREGLVL	FTHELQTYTA	TEYFVSSRM	FEPRKPTVSD	FVQIESCVVT
TGEV	ASDG-DRTFG	LVVKDQVLT	FRN-----LD	DKFYLTPTMT	YQPRVATSSD	FVQIEGCDVL
CaCoV	ASDG-SRTFG	LVVEDVQVLT	FRN-----LD	EKFYLTPTMT	YQPRVATSSD	FVQIEGCDVL
FeCoV	ASDG-DRTFG	LVVKDQVLT	FRN-----LD	DKFYLTPTMT	YQPRVATSSD	FVQIEGCDVL
Por Resp C	ALDV-DRTFG	LVVKDQVLT	FRN-----LD	DKFYLTPTMT	YQPRVATSSD	FVQIEGCDVL
OC43	IAG-----DRG	IAPKSGYFVN	VN-----	NTWMTGSGY	YYPEPITENN	VVMSTCAVN
BoCoV	IAG-----DRG	IAPKSGYFVN	VN-----	NTWMTGSGY	YYPEPITENN	VVMSTCAVN
MHV	ISG-----DRG	LAPKAGYFVQ	DD-----	GEWKFTGSNY	YYPEPITDKN	SVVMSSCAVN
Rat CoV	ISG-----DRG	LAPKAGYFVQ	DH-----	GEWKFTGSNY	YYPEPITDKN	SVVMSSCAVN
PHEV	IAG-----DIG	ISPKSGYFVN	VN-----	NSWMTGSGY	YYPEPITQNN	VVMSTCAVN
AIBV	VKPANASQYA	IVPANGRGIF	IQVN-----	GSYYITARDM	YMPRAITAGD	VVTLTSCQAN
SARS	HEG-----KA	YFPREGVVF	NG-----	TSWFITQRNF	FSPQIITDKN	TFVSGNCDVV

	1385	1395	1405	1415	1425	1435
EMCR S	FVNISRVELH	TVIP-DYVDV	NKTLQEFQAN	L-PKYVKNPF	DLTPFNLTYL	NLSSELKQLE
229E S	FVNISRSELQ	TVIP-EYIDV	NKTLQELSYK	L-PNYTVDPD	VVEQYNQTL	NLTSEISTLE
PEDV	YVNLTSQQLP	DVIP-DYIDV	NKTLQELILAS	L-PNRTGPSL	PLDVFNATYL	NLTGEIADLE
TGEV	FVNATVSDLP	SIIP-DYIDI	NQTVQDILEN	FRPNWTVPEL	TFDIFNATYL	NLTGEIDDL
CaCoV	FVNGTVIELP	SIIP-DYIDI	NQTVQDILEN	FRPNWTVPEL	PLDIFNATYL	NLTGEINDLE
FeCoV	FVNATVIDLP	SIIP-DYIDI	NQTVQDILEN	FRPNWTVPEL	TLDIFNATYL	NLTGEIDDL
Por Resp C	FVNTTVSDLP	SIIP-DYIDI	NQTVQDILEN	FRPNWTVPEL	TLDVFNATYL	NLTGEIDDL
OC43	YTKAPYVMLN	TSIP-NLPDF	KEELDQWFKN	QTSVAPDLSL	DY--INVTF	DLQVEMN---
BoCoV	YTKAPDVMNL	ISTP-NLHDF	KEELDQWFKN	QTSVAPDLSL	DY--INVTF	DLQVEMN---
MHV	YTKAPEVFLN	TSIP-NLPDF	KEELDQWFKN	QTSIAPDLSL	DY--INVTF	DLQVEMN---
Rat CoV	YTKAPEVFLN	TSIT-NLPDF	KEELDQWFKN	QTSIVPDLSF	DY--INVTF	DLQVEMN---
PHEV	YTKAPDMLN	TSIP-NLPDF	KEELYQWFKN	QSSVAPDLSL	DY--INVTF	DLQVEMN---
AIBV	YVSVNKTIVT	TFVDNDDDF	NDELKSWWND	T--KHELPDF	DKFNVTVPIL	DIDSEID---
SARS	IGIINTVYD	PLQP-ELDSF	KEELDQWFKN	HTSPDVLG	ISG-INASVV	NIQKEID---

	1445 1455 1465 1475 1485 1495
EMCR S	AKTASLFQTT VELQGLIDQI NSTYVDLKL NREFENYIKWP WVVWLIISVV FVVLSSLVLF
229E S	NKSAELNYTV QKLQTLIDNI NSTLVDLKL NRVETIYKWP WVVWLCISVV LIFVVSMLLL
PEDV	QRSESLRNTT EELRSLINNI NNTLVNLEWL NRVETIYKWP WVVWLIIVIV LIFVVSLLVF
TGEV	FRSEKLHNTT VELAILIDNI NNTLVNLEWL NRIETIYKWP WYVWLLIGLV VIFCIPLLLF
CaCoV	FRSEKLHNTT VELAILIDNI NNTLVNLEWL NRIETIYKWP WYVWLLIGLV VIFCIPILLF
FeCoV	FRSEKLHNTT VELAILIDNI NNTLVNLEWL NRIETIYKWP WYVWLLIGLV VIFCIPLLLF
Por Resp C	FRSEKLHNTT VELAILIDNI NNTVNVLEWL NRIETIYKWP WYVWLLIGLV VIFCIPLLLF
OC43	----- -RLQEAIKVL NQSYINLKDI GTYEYVVKWP WYVWLLICLA GVAMLVLLFF
BoCoV	----- -RLQEAIKVL NQSYINLKDI GTYEYVVKWP WYVWLLIGFA GVAMLVLLFF
MHV	----- -RIQDAIKKL NESYINLKDV GTYEMYVKWP WYVWLLIGLA GVAVCVLLFF
Rat CoV	----- -RIQDAIKKL NESYINLKDI GTYEMYVKWP WYVWLLIGLA GVAVCVLLFF
PHEV	----- -RLQEAIKVL NQSYINLKDI GTYEYVVKWP WYVWLLIGLA GVAMLVLLFF
AIBV	----- -RIQGVIIQL NQSLIDLEKL SILKTIYKWP WYVWLAIAFA TIIFILILGW
SARS	----- -RLNEVAKNL NESLIDLQEL GKYEYIYKWP WYVWLGFIAG LIAIVMVTIL

	1505 1515 1525 1535 1545
EMCR S	CCLSTGCCGC CNCLTSSMRG CCDCGSKLP YYFEKVVHQ -----
229E S	CCCSTGCCGF FSCFASSIRG CCES--TKLP YYDVEKIHQ -----
PEDV	CCISTGCCGC CGCCGACFSG CCRG-PRLOP YEAFEKVVHQ -----
TGEV	CCCSTGCCGC IGCLGSCCHS ICSR-RQFEN YEPIEKVVHV -----
CaCoV	CCCSTGCCGC IGCLGSCCHS ICSR-GQFES YEPIEKVVHV -----
FeCoV	CCFSTGCCGC IGCLGSCCHS ICSR-RQFEN YEPIEKVVHV -----
Por Resp C	CCCSTGCCGC IGCLGSCCHS IFSR-RQFEN YEPIEKVVHV -----
OC43	ICCTG-CG- -TSCFKKCGG CDDYTGQEQE LVIKT---SH DD-----
BoCoV	ICCTG-CG- -TSCFKICGG CDDYTGQEQE LVIKT---SH DD-----
MHV	ICCTG-CG- -SCCFKKCGN CCDECGGHQD SIVIHNISSH ED-----
Rat CoV	ICCTG-CG- -SCCFKKCGN CCDEYGGROA GIVIHNISSH ED-----
PHEV	ICCTG-CG- -TSCFKKCGG CDDYTGQEQE FVIKT---SH DD-----
AIBV	VFFMTGCCGC CCGCFGIMPL MSKCGKSSY YTTFDNDVVT EQYRPKKS
SARS	LCCMTSCCS- -CLKGACSCG SCCKFDEDD S EPVLKGVKLH YT-----

f. Putative Orf 4a

	5 15 25 35 45 55
EMCR 4a	MPFGLFQLT LESTINKSVA NLKLPHPDVT VLRDNLKPVT TLSTITAYLL VSLFVTFYAL
229E 4a	MALG-LFTLQ LVSANQSL S NAKVSAEVS R QVIQDVKDGT VTFNLAYTL MSLFVVYFAL

	65 75 85 95 105 115
EMCR 4a	FKPLTARGRV ACFVLKLLTL SVYVPLLVL F GMYLDSFIIF FLRCCFDSYM LAIMPISNKN
229E 4a	FKARSHRGRA ALIVEKILIL FVYVPLLYWS QAYIYATLIA VILLG-RFFH TAWHCWLYKT

	125 135 145 155 165 175
EMCR 4a	FSFVLFNVTK LCFVSGKCWY LEQSFYENRF AAIYGGDHYV VLGGETITFV SFDDLYVAIR
229E 4a	WDFIVFNVTT LCYAR-----

	185 195 205 215 225
EMCR 4a	GSCEKNLQLM RKVDLYNGAV IYIFAEPPV GIVYSSQLYE DVPSIN
229E 4a	-----

g. Putative Orf 4ab

	5	15	25	35	45	55
EMCR 4a	MPFGGLEFQLT	LESTINKSVA	NLKLPPHDVT	VLRDNLKPVT	TLSTITAYLL	VSLFVTFYFAL
229E 4a	MALG-LFTLQ	LVSANQSL	NAKVSAEVS	QVIQDVKDG	VTFNLLAYTL	MSLFVVYFAL
229E 4b	-----	-----	-----	-----	-----	-----
	65	75	85	95	105	115
EMCR 4a	FKPLTARGRV	ACFVLKLLTL	SVYVPLLVL	GMVLDSEFI	FLRCCFDSYM	LAIMPISNKN
229E 4a	FKARSHRGRA	ALIVFKILIL	FVYVPLLYS	QAYIYATLIA	VILLG-RFFH	TAWHCWLYKT
229E 4b	-----	-----	-----	-----	-----	-----
	125	135	145	155	165	175
EMCR 4a	FSEVLENVTK	LCFVSGKCY	LEQSFYENRF	AAIYGGDHYV	VLGGETITFV	SFDDLYVAIR
229E 4a	WDFIVENVTT	LCYAR-----	-----	-----	-----	-----
229E 4b	-----	---MQGKCW	FLENKALKPF	VCFYGGDQFL	YIGDRIVSYF	STNDLYVALR
	185	195	205	215	225	
EMCR 4a	GSCEKNLQLM	RKVDLYNGAV	IYIFAEPPV	GIVYSSQLYE	DVPSIN	
229E 4a	-----	-----	-----	-----	-----	
229E 4b	GRIDKDLSL	RKVELYNGEC	VYLFCEHPAV	GIVNTDFKLE	IM....	

h. Putative Orf E

	5	15	25	35	45	55
EMCR E	---MFLRLI	DDNG-IVLNS	ILWLLVMIFF	F-VLAMTFIK	LIQLCFTCHY	FFSRTLYQP-
229E	---MFLKLV	DDHA-LVVNV	LLWCVVLI	L-LVCITIIK	LKLCFTCHM	FCNRTVYGP-
PEDV	---MLQLV	NDNG-LVVNV	ILWLFVLFFL	L-IISITFVQ	LVNLCFTCHR	LCNSAVYTP-
TGEV	MTFPRALTVI	DDNG-MVINI	IFWFLLIIL	I-LLSIALLN	IIKLCMVCCN	LGRTVIIIP-
CaCoV	MTFPRALTVI	DDNG-MVISI	IFWFLLIIL	I-LFSIALLN	IIKLCMVCCN	LGRTVIIIP-
FeCoV	MTFPRAFTII	DDHG-MVVS	FFWLLLIIL	I-LFSIALLN	VIKLCMVCCN	LGKTIIVLP-
Por Resp C	MTFPRALTVI	DDNG-MVISI	IFWFLLIIL	I-LLSIALLN	IIKLCMVCCN	LGRTVIIIP-
OC43	--MFADAYL	ADTV-WYVGQ	IIFIVAICLL	VTIIVVAFLA	TFKLCIQLCG	MCNTLVLS-
BoCoV	--MFADAYF	ADTV-WYVGQ	IIFIVAICLL	VIIIVVAFLA	TFKLCIQLCG	MCNTLVLS-
PHEV	--MFADAYL	ADTV-WYVGQ	IIFIVAICLL	VIIIVVAFLA	TFKLCIQLCG	MCNTLVLS-
MHV	---MENLFL	TDTV-WYVGQ	IIFIVAVCLM	VTIIVVAFLA	SIKLCIQLCG	LCNTLLLS-
Rat CoV	---MENLFL	IDTV-WYVGQ	IIFIVAVCLM	VTIIVVAFLA	SIKLCIQLCG	LCNTLLLS-
AIBV	--MNLLNKS	EENG-SFLTA	LYIIVGFLAL	Y-LLGRALQA	FVQAADACCL	FWYTWVVI
SARS	---MYSFVS	EETGTLIVNS	VLLFLAFVVF	L-LVTLAILT	ALRLCAYCCN	IVNVSIVK-
	65	75	85	95	105	
EMCR E	---VYKIFL	-----	---AYQDYM	--QIAPV-PA	EVLNV-----	--
229E	---IKNVYH	-----	---IYQSYM	--HIDPF-PK	RVIDF-----	--
PEDV	---IGRLYR	-----	---VYKSYM	--RIDPL-PS	TVIDV-----	--
TGEV	---AQHAYD	-----	---AYKNFM	--RIKAYNPD	GALLA-----	--
CaCoV	---ARHAYD	-----	---AYKNFM	--QIRAYNPD	EALLV-----	--
FeCoV	---ARHAYD	-----	---AYKTFM	--QIRAYNPD	EALLV-----	--
Por Resp C	---VQHAYD	-----	---AYKNFM	--RIKAYNPD	GALLV-----	--
OC43	---SIYVFNR	GR-----	---QFYEFYN	--DVKPP-VL	DVDDV-----	--
BoCoV	---SIYVFNR	GR-----	---QFYEFYN	--DVKPP-VL	DVDDV-----	--
PHEV	---SIYVFNR	GR-----	---QFYEFYN	--DVKPP-VL	DVDDV-----	--
MHV	---SICVYNR	SK-----	---QLYKYNN	E-EVRPP-PL	EVDDIIQTL	--
Rat CoV	---SIYVYNR	SK-----	---QLYKYNN	E-EVRPP-PL	EVDDIIQTL	--
AIBV	AKGTAFVYKY	TYGRKLNNPE	LEAVIVNEFP	KNGWNNKNPA	NFQDAQRDKL	YS
SARS	---TVVYVS	-----	---RVKNLN	--SSEGV-PD	LLV-----	--

i. Putative Orf M (Matrix protein)

	5	15	25	35	45	55
EMCR	-----	-----	-----	-----	-----	-M SNSS-----
229E	-----	-----	-----	-----	-----	-M SNDN-----
PEDV	-----	-----	-----	-----	-----	-M SNGS-----
TGEV	-----	-----	-----MK	ILLILACVIA	CACGERYCAM	KSDTDLSCRN
CaCoV	-----	-----	-----MKK	ILFLACAIA	CVYGERYCAM	TESS-TSCRN
FeCoV	MHMPPIRPLC	KPRHIPTKH	FWFELNKMKY	ILLILACIIA	CVYGERYCAM	QDSG-LQCIN
PRCoV	-----	-----	-----MK	ILLILACAIA	CTCGERYCAM	KDDTGLSCRN
OC43	-----	-----	-----	-----	-----	-M SSKT-----
PHEV	-----	-----	-----	-----	-----	-M SSPT-----
BoCoV	-----	-----	-----	-----	-----	-M SSVT-----
MHV	-----	-----	-----	-----	-----	-M TSTTQ-----
RatSAV	-----	-----	-----	-----	-----	-M SSTTP-----
AIBV	-----	-----	-----	-----	-----	-M PNETN-----
SARS	-----	-----	-----	-----	-----	-M ADNG-----

	65	75	85	95	105	115
EMCR	-----V	PLSEVYVHLR	NWNFSWNLL	TVFIVVLQYG	HYKYSRLLYG	LKMSVLWCLW
229E	-----C	-TGDIVTHLK	NWNFGWNVIL	TIFIVILQFG	HYKYSRLFYG	LKMLVLWLLW
PEDV	-----I	PVDEVIEHLR	NWNFTWNIL	TILLVVLQYG	HYKYSVFLYG	VKMAILWILW
TGEV	STASDCESCF	NGGDLIHLA	NWNFSWSIIL	IVFITVLQYG	RPQFSWFVYG	IKMLIMWLLW
CaCoV	STAGNCASCF	ETGDLIHLA	NWNFSWSVIL	IIFITVLQYG	RPQFSWFVCG	IKMLIMWLLW
FeCoV	GTNSRCQTCF	ERGDLIHLA	NWNFSWSVIL	IVFITVLQYG	RPQFSWLVYG	IKMLIMWLLW
PRCoV	GTASDCESCF	NRGDLIHLA	NWNFSWSIIL	IIFITVLQYG	RPQFSWFVYG	IKMLIMWLLW
OC43	--TPAPVYIW	TADEAIKFLK	EWNFSLGIIL	LFITIIILQFG	YTSRSMFVYV	IKMIILWLMW
PHEV	--TPVPVISW	TADEAIKFLK	EWNFSLGIIV	LFITIIILQFG	YTSRSMFVYV	IKMVILWLMW
BoCoV	--TPAPVYTW	TADEAIKFLK	EWNFSLGIIL	LFITIIILQFG	YTSRSMFVYV	IKMIILWLMW
MHV	--APQPVYQW	TADEAIRFLK	EWNFSLGIIL	LFVTIILQFG	YTSRSMFVYV	VKMILLWLMW
RatSAV	--APQTVYQW	TADVAVRFLK	EWNFSLGIIL	LFITIIILQFG	YTSRSMFIYV	VKMIILWLMW
ATBV	-----CTL	DFEQSVQLFK	EYNLFITAFI	LFLTIILQYG	YATRSKVIYT	LKMIVLWCFW
SARS	-----TI	TVEELKQLE	QWNLVIGFLF	LAWIMLLQFA	YSNRNRFYI	IKLVFLWLLW

	125	135	145	155	165	175
EMCR	PLVLALSIFD	CFVNFNVD-W	VFFGFSILMS	IITLCLWVMY	FVNSFRLWRR	VKTEWAFNPE
229E	PLVLALSIFD	TWANWDSN-W	AFVAFSFFMA	VSTLVMWVMY	FANSFRLFRR	ARTFWAWNPE
PEDV	PLVLALSIFD	AWASFQVN-W	VFFAFSILMA	CITLMLWIMY	FVNSIRLWRR	THSWWSFNPE
TGEV	PVVLALTIFN	AYSEYQVSRY	VMFGFSIAGA	IVTFVLWIMY	FVRSIQLYRR	TKSWWSFNPE
CaCoV	PIVLALTIFN	AYLEYRVSRY	VMFGFSVAGA	TVTTFILWIMY	FVRSIQLYRR	TKSWWSFNPE
FeCoV	PIVLALTIFN	AYSEYQVSRY	VMFGFSVAGA	VVTFALWMMY	FVRSVQLYRR	TKSWWSFNPE
PRCoV	PIVLALTIFN	AYSEYQVSRY	VMFGFSIAGA	IVTFVLWIMY	FVRSIQLYRR	TKSWWSFNPE
OC43	PLTIILTIFN	--CVYALN-N	VYLGFSIVFT	IVAIIMWIVY	FVNSIRLFIR	TGSFWSFNPE
PHEV	PLTIILTIFN	--CVYALN-N	VYLGFSIVFT	IVAIIMWVYV	FVNSIRLFIR	TGSWWSFNPE
BoCoV	PLTIILTIFN	--CVYALN-N	VYLGFSIVFT	IVAIIMWIVY	FVNSIRLFIR	TGSWWSFNPE
MHV	PLTIVLCIFN	--CVYALN-N	VYLGFSIVFT	IVSIIMWIMY	FVNSIRLFIR	TGSWWSFNPE
RatSAV	PLTIVLCIFN	--CVYALN-N	VYLGFSIVFT	IVSIIMWIMY	FVNSIRLFIR	TGSWWSFNPE
AIBV	PLNIAGVIS	--CTYPPN-T	GGLVAAIILT	VFACLSFVG	WQSGIRLFKR	CRSWWSFNPE
SARS	PVTLACFVLA	--AVYRIN-W	VTGGIAIAMA	CIVGLMWLSY	FVASFRLFAR	TRSMWSFNPE

	185	195	205	215	225	235
EMCR	TNAIISLQVY	-GHNYLPPVM	AAPTGVTLTL	LSGVLLVDGH	KIATRVQVGQ	LPKYVIVATP
229E	VNAITVTTVL	-GQTYYPQIQ	QAPTGITVTL	LSGVLYVDGH	RLASGVQVHN	LPEYMTVAVP
PEDV	TDALLTTSVM	-GRQVCIPVL	GAPTGVTLTL	LSGTLVVEGY	KVATGVQVQS	LPNFVTVAKA
TGEV	TKAILCVSAL	-GRSYVLPLE	GVPTGVTLTL	LSGNLYAEGF	KIAGGMNIDN	LPKYVMVALP
CaCoV	TSAILCVSAL	-GRSYVLPLE	GVPTGVTLTL	LSGNLYAEGF	KIAGGMNIDN	LPKYVMVALP
FeCoV	TNAILCVNAL	-GRSYVLPLE	GVPTGVTLTL	LSGNLYAEGF	KMAGGLTIEH	LPKYVMIATP
PRCoV	TNAILCVSAL	-GRSYVLPLE	GVPTGVTLTL	LSGNLYAEGF	KIAGGMTIDN	LPKYVMVALP
OC43	TNNLMCIDMK	-GRMYVRPII	EDYHTLTATI	IRGHLYIQGI	KLGTGYSLAD	LPAYMTVAK-
PHEV	TNNLMCIDMK	-GRMYVRPII	EDYHTLTATI	IRGHLYIQGI	KLGTGYSLSD	LPAYVTVAK-
BoCoV	TNNLMCIDMK	-GRMYVRPII	EDYHTLTATI	IRGHLYMQGI	KLGTGYSLSD	LPAYVTVAK-
MHV	TNNLMCIDMK	-GTVYVRPII	EDYHTLTATI	IRGHLYMQGV	KLGTGFSLSL	LPAYVTVAK-
RatSAV	TNNLMCIDMK	-GTVYVRPII	EDYHTLTATN	VRGHLYMQGV	KLGTGFSLSL	LPAYVTVAK-
AIBV	SNAYGSLLT	NGQOCNFAIE	SVPMVLSPII	KNGVLYCEGQ	WLAK-CEPDH	LPKDI FVCTP
SARS	TNILLNVPLR	-GTIVTRPLM	ESELVIGAVI	IRGHLRMAGH	PLGR-CDIKD	LPKEITVAT-

	245	255	265	275	285	
EMCR	STTIVCDRVG	RSVNETSQTG	WAFYVRKXHG	DFSGVASQEG	VLSEREKLLH	LI
229E	STTIIVSRVG	RSVNSQNSGT	WVFYVRVKHG	DFSAVSSPMS	NMTENERLLH	FF
PEDV	TTTIVYGRVG	RSVNASSGTG	WAFYVRSKHG	DYSAVSNPSA	VLTDESEKVLH	LV
TGEV	SRTIVYTLVG	KKLKASSATG	WAYYVKSAG	DYSTEAR-TD	NLSEQEKLH	MV
CaCoV	VRTIVYTLVG	KKLKASSATG	WAYYVKSAG	DYSTEAR-TD	NLSEHEKLLH	MV
FeCoV	SRTIVYTLVG	KKLKASSATG	WAYYVKSAG	DYSTEAR-TD	NLSEHEKLLH	MV
PRCoV	SRTIVYTLVG	KKLKASSATG	WAYYVKSAG	DYSTEAR-TD	NLSEQEKLH	MV
OC43	VTHLCTYKRG	FLDRISDTSG	FAVYVKSAG	NYRLPSTQKG	SGMDTALLRN	NI
PHEV	VTHLCTYKRG	FLDRIGDTSG	FAVYVKSAG	NYRLPSTHKG	SGMDTALLRN	NI
BoCoV	VSHLLTYKRG	FLDKIGDTSG	FAVYVKSAG	NYRLPSTQKG	SGMDTALLRN	NI
MHV	VSHLCTYKRA	FLDKVDGVSG	FAVYVKSAG	NYRLPSN-KP	SGMDTALLR-	-I
RatSAV	VSHLCTYKRA	FLDKVDGVSG	FAVYVKSAG	NYRLPSN-KP	SGADTALLR-	-I
AIBV	DRRNIRYMQ	KYTGQSGNK	KRFATFVYAK	QSVDTGELES	VATGGSSTLYT	--
SARS	SRTLSYKLG	ASQRVGTDSG	FAAYNRYRIG	NYKLNTDRAG	SDNIALLVQ	--

j. Putative Orf N (Nucleoprotein)

	5	15	25	35	45	55
EMCR	-----	--MAS----	---VN---W	ADDR-----	--AARKKF--	-----
229E	-----	--MAT----	---VK---W	ADASEPQ---	--RGRQGR--	-----
PEDV	-----	--MAS----	---VS---F	QDRG-----	--RKR-----	-----
TGEV	-----	--MANQGQR-	---VS---W	GDESTKT---	--RGRSNSRG	RKNNN----
FeCoV	-----	--MATQGQR-	---VN---W	GDEPSKR---	--RGRSNSRG	RKNND----
PRCoV	-----	--MANQGQR-	---VS---W	GDESTKI---	--RGRSNSRG	RKINN----
CaCoV	-----	--MASQGQR-	---VS---W	GDESTKR---	--RGRSNSRG	RKNND----
RSDACoV	MSFVPGQENA	GSRSSSGNRA	GNGILKKTW	ADQTERGQNN	GNGRRRNQPK	QTATTQ-PNT
MHV	MSFVPGQENA	GSRSSSGNRA	GNGILKKTW	ADQTERG---	-NRRRRNHFK	QTATTQ-PNA
PHEV	MSFTPGKQSS	-SRASSGNRS	GNGILK---	ADQSDQSRNV	QTRGRRVQSK	QTATSQQPSG
OC43	MSFTPGKQSS	-SRASSGNRS	GNGILK---	ADQSDQSRNV	QTRGRRAQPK	QTATSQQPSG
BoCoV	MSFTPGKQSS	-SRASFGNRS	GNGILK---	ADQSDQSRNV	QTRGRRAQPK	QTATSQLPSP
SARS	-----	--MSDNGPQS	NQRSAPRITF	GGPTSDTDNN	QNGRRNGARP	KQRRPQ----
AIBV	-----	--MASG----	---K---A	AGKTDAPAPV	IKLGGPKPPK	VGSS-----

	65	75	85	95	105	115
EMCR	----PPPSFY	MPLLVSSDKA	PYRVIPRNLV	PIKGKNG-DE	QIGYWNVQER	--WRMRRGQR
229E	----IPYSLY	SPLLVDSE-Q	PWKVIPRNLV	PINKKDK-NK	LIGYWNVQER	--FRTRKGRK
PEDV	----VPLSLY	APLRVTNDKP	LSKVLANNV	PTNKGKNG-DQ	QIGYWNEQIR	--WRMRRGQR
TGEV	----IPLSFF	NPITLQQGSK	FWNLCPDVF	PKGIGNR-DQ	QIGYWNQTR	--YRMVKGQR
FeCoV	----IPLSFF	NPITLQQGSK	FWNLCPDVF	PKGIGNR-DQ	QIGYWNQTR	--YRIVKGQR
PRCoV	----IPLSFF	NPITLQQGAK	FWNSCPDVF	PKGIGNR-DQ	QIGYWNQTR	--YRMVKGQR
CaCoV	----IPLSFF	NPITLQQGSK	FWNLCPDVF	PKGIGNR-DQ	QIGYWNQTR	--YRMVKGRR
RSDACoV	GSVVPYHSWF	SGITQFQKKG	EFQFAGGQGV	PIANGIPPSE	QKGYWYRHNR	RSFKTPDGGQ
MHV	GSVVPYHSWF	SGITQFQKKG	EFQFAGGQGV	PIASGIPASE	QKGYWYRHNR	RSFKTPDGGQ
PHEV	GTVPYYSWF	SGITQFQKKG	EFQFAGGQGV	PIAPGVVPSTE	AKGYWYRHNR	RSFKTADGNQ
OC43	GNVVPYYSWF	SGITQFQKKG	EFQFAGGQGV	PIAPGVVPSTE	AKGYWYRHNR	RSFKTADGNQ
BoCoV	GNVVPYYSWF	SGITQFQKKG	EFQFAGGQGV	PIAPGVVPSTE	AKGYWYRHNR	RSFKTADGNQ
SARS	GLPNNTASWF	TALTQHGK-E	ELREFPRGQGV	PINTNSGPD	QIGYRRRATR	R-VRGGDGKM
AIBV	----GNASWF	QAIAKAKLNT	PPPKFEGSGV	PDNENIKPSQ	QHGYYRRQAR	--FKPGKGGR

	125	135	145	155	165	175
EMCR	VDLPKPVHXY	YLGTPGHKDL	KFRQRSDGVV	WVAKEGAKTV	NTSLGNRK--	RNQPKEPKF
229E	VDLSPKLHXY	YLGTPGHKDA	KFRERVEGVV	WVAVDGAKE	PTGYGVRR--	KNSEPEIPHF
PEDV	IEQPSNWHFY	YLGTPGHGDL	RYRTRTEGVF	WVAKEGAKTE	PTNLGVVK--	ASEKPIIPKF
TGEV	KELPERWFFY	YLGTPGHADA	KFKDKLDGVV	WVARDGAMNK	PTTLGSRG--	ANNESKALKF
FeCoV	KELAERWFFY	YLGTPGHADA	KFKDKLDGVV	WVARDGAMNK	PTTLGTRG--	TNNEKPLRF
PRCoV	KELPERWFFY	YLGTPGHADA	KFKDKLDGVV	WVARDGAMNK	PTTLGSRG--	ANNESKALKF
CaCoV	KNLPEKWFFY	YLGTPGHADA	KFKDKLDGVV	WVARGDSMTK	PTTLGTRG--	TNNEKALKF
RSDACoV	KQLLPRWYFY	YLGTPGHAGA	SFGDSIEGVF	WVANSQADTN	TSADIVERDP	SSHEAIPTRF
MHV	KQLLPRWYFY	YLGTPGHAGA	EYGDIDGVV	WVASQADTK	TPADIVDRDP	SSHEAIPTRF
PHEV	RQLLPRWYFY	YLGTPGHAKD	QYGTIDGVV	WVASQADIN	TPADIVDRDP	SSDEAIPTRF
OC43	RQLLPRWYFY	YLGTPGHAKD	QYGTIDGVV	WVASQADVN	TPADIVDRDP	SSDEAIPTRF
BoCoV	RQLLPRWYFY	YLGTPGHAKD	QYGTIDGVV	WVASQADVN	TPADILDRDP	SSDEAIPTRF
SARS	KELSPRWYFY	YLGTPGEASL	PYGANKGIV	WVATEGALNT	PKDHIGTRNP	NNNAATVLQL
AIBV	KPVDPADWYFY	YTGTPAADL	NWGDQDGVV	WVAAGADTK	SRSNQTRDP	DKFDQYPLRF

	185	195	205	215	225	235
EMCR	SIALPPPLSV	VEFEDRSNNS	SRASSRSSTR	-----	-----NNSR	DS-----
229E	NQKLPNGVT	VEEPD-----	SRAPSRSQSR	-----	-----SQSR	-----
PEDV	SQQLPSVVEI	VEPNTTP--A	SRANSRSRSR	GNGNRSRSP	SNNRGNNQSR	GNSQNRGNNO
TGEV	DGKVPGEFQL	EVNQ-----	-RDNSRSRSQ	-----	-----	-----
FeCoV	DGKIPPOFQL	EVNRS-----	-RNNSRSRSG	-----	-----	-----
PRCoV	DGKVPGEFQL	EVNQ-----	-RDNSRSRSQ	-----	-----	-----
CaCoV	DVKVPSEFHL	EVNQL-----	-RDNSRSRSQ	-----	-----	-----
RSDACoV	APGTVLPOGF	YVEGS-----	GRSAPASRSR	-----	-----	-----
MHV	APGTVLPOGF	YVEGS-----	GRSAPASRSR	-----	-----	-----
PHEV	PPGTVLPOGY	YIEGS-----	GRSAPNSRST	-----	-----	-----
OC43	PPGTVLPOGY	YIEGS-----	GRSAPNSRST	-----	-----	-----
BoCoV	PPGTVLPOGY	YIEGS-----	GRSAPNSRST	-----	-----	-----
SARS	PQGTTLPOGF	YAEGS-----	-RGGSQASSR	-----	-----	-----
AIBV	SDGGPDGNER	WDFIP-----	-LN-RGRSG	-----	-----	-----

	245	255	265	275	285	295
EMCR	SRSTSRQ---	-----QSR-	TRSDSNQS--	-----S-SDL	VAAVTLALKN	LGFDN--QSK
229E	GRGESKP---	-----QSRN	PSSDRNHN--	-----SQDDI	MAVAAALKS	LGFDKP-QEK
PEDV	GRGASQNRGG	NNNNNNKSRN	QSNNRNQSDN	RGGVTSRDDL	VAAVKDALKS	LGIGEN-PDR
TGEV	SRSRSRNR--	-----SQSRG	RQGFNNKK--	-----DDSV	EQAVLAALKK	LGVDTE-KQQ
FeCoV	SRSVSRNR--	-----SQSRG	RHHSNNQ--	-----NNNV	EDTIVAVLEK	LGVT-D-KQ-
PRCoV	SRSRSRNR--	-----SQSRG	RQGSNNKK--	-----DDSV	EQAVLAALKK	LGVTTE-KQQ
CaCoV	SRSQSRNR--	-----SQSRG	RQLSNNKK--	-----DDNV	EQAVLAALKK	LGVDTE-KQQ
RSDACoV	SRSQSRGP--	-----NNRA	RSSSNQRQ--	-----PASTV	KPDMAEEIAA	LVLAN---LG
MHV	SRSQSRGP--	-----NNRA	RSSSNQRQ--	-----PASAV	KPDMAEEIAA	LVLAK---LG
PHEV	SRAPNRAPS-	-----AGSRS	RANSGNRT--	-----STPGV	TPDMADQIAS	LVLAK---LG
OC43	SRTSSRASS-	-----AGSRS	RANSGNRT--	-----PTSGV	TPDMADQIAS	LVLAK---LG
BoCoV	SRASSRASS-	-----AGSRS	RANSGNRT--	-----PTSGV	TPDMADQIAS	LVLAK---LG
SARS	SSSRSRGN--	-----SRNST	PGSSSRGNS--	-----PARMA	SGGGETALAL	LLLDRLNQL
AIBV	-RSTAASS--	-----AAASRA	PSREGSRG--	-----RRSDS	GDDLARAAL	IIQDQ----

	305	315	325	335	345	355
EMCR	SPSSSGTSTP	K-----K-	---PNKPLSQ	PRADKPS---	-QLKKPRWKR	VPTR--EENV
229E	DKKSAKTGTP	KPSRNQSPAS	SQTSAKSLAR	SQSSETKEQK	HEMQKPRWKR	QPNDDVTSNV
PEDV	HKQOQPKQKE	K-SDN---SG	KNTPKKNKSR	ATSKERD---	-LKDIPEWRR	IPKG--ENSV
TGEV	QRSRSKSKER	S-----	---NSKTR	DTTPKNE---	---NKHTWKR	TAGK---GDV
FeCoV	-RSRSKPRER	S-----	---DSKPR	DTTPKNA---	---NKHTWKR	TAGK---GDV
PRCoV	QRSRSKSKER	S-----	---NSKTR	DTTPKNE---	---NKHTWKR	TAGK---GDV
CaCoV	-RSRSKSKER	S-----	---SSKTR	DTTPKNE---	---NKHTWKR	TAGK---GDV
RSDACoV	-KDAGQPKQV	T-----	---KQSAK	EVROKIL---	---NKPRQKR	TPNK--QCPV
MHV	-KDAGQPKQV	T-----	---KQSAK	EVROKIL---	---TKPRQKR	TPNK--QCPV
PHEV	-KDATKPKQV	T-----	---KQTAK	EVROKIL---	---NKPRQKR	SPNK--QCTV
OC43	-KDATKPKQV	T-----	---KHTAK	EVROKIL---	---NKPRQKR	SPNK--QCTV
BoCoV	-KDATKPKQV	T-----	---KQTAK	EIROKIL---	---NKPRQKR	SPNK--QCTV
SARS	SKVSGKGQQQ	Q-----	---GQTVTK	KSAAEAS---	---KKPRQKR	TATK--QYNV
AIBV	---QKKSRI	T-----	---KAKAD	EMAHRRY---	---CKRT	IPPN---YRV

	365	375	385	395	405	415
EMCR	IQCFGPRDFN	H---NMGDS	LVQNGVDAKG	FPQLAELIPN	QAALFFDSEV	STDEVG----
229E	TQCFCGRDL	H---NFGSAG	VVANGVKAKG	YPQFAELVPS	TAAMLFDSHI	VSKEG----
PEDV	AACFCGRGGF	K---NFGDAE	FVEKGVDAAG	YAQIASLAPN	VAALLFGGNV	AVRELA----
TGEV	TRFYGARSSS	A---NFGD	LVANGSSAKH	YPQLAECVPS	VSSILFGSYW	TSKEDG----
FeCoV	TTFYGARSSS	A---NFGD	LVANGNAAK	YPQLAECVPS	VSSIIFGSQW	SAEEAG----
PRCoV	TRFYGARSSS	A---NFGD	LVANGSSAKH	YPQLAECVPS	VSSILFGSYW	TSKEDG----
CaCoV	TKFYGARSSS	A---NFGD	LVANGNAAKH	YPQLAECVPS	VSSILFGSHW	TAKEDG----
RSDACoV	QQCFGKRGPN	Q---NFGGPE	MLKLGTSDPQ	FPILAEALPT	PGAFFFGSKL	ELVKKN--SG
MHV	QQCFGKRGPN	Q---NFGGSE	MLKLGTSDPQ	FPILAEALPT	PSAFFFGSKL	ELVKKN--SG
PHEV	QQCFGKRGPN	Q---NFGGGE	MLKLGTSDPQ	FPILAEALPT	AGAFFFGSRL	ELAKVQNL
OC43	QQCFGKRGPN	Q---NFGGGE	MLKLGTSDPQ	FPILAEALPT	AGAFFFGSRL	ELAKVQNL
BoCoV	QQCFGKRGPN	Q---NFGGGE	MLKLGTSDPQ	FPILAEALPT	AGAFFFGSRL	ELAKVQNL
SARS	TQAFGRGPE	QTQGNFGDQ	LIRQGTDYKH	WPQIAQFAPS	ASAFFGMSRI	GMEVTP----
AIBV	DQVFGPRTKG	K-EGNFGDDK	MNEEGIKDGR	VTANLNLVPS	SHACLFGRSV	TPKLQL----

	425	435	445	455	465	475
EMCR	-----DNV	QITYT---Y	KMLVAKDNKN	LPKFIEQISA	FTKPS-----	SIKEMQSQSS
229E	-----NTV	VLFTT---T	RVTVPKDHHP	LGFLEELNA	FTR-----	EMQQLFLNLP
PEDV	-----DSY	EITYN---Y	KMTVPKSDPN	VELLVQSDA	FRTGN-----	AKLQKKKEKK
TGEV	-----DQI	EVTFT---H	KYHLPKDDPK	TGQFLQIQNA	YARPS-----	EVAKEQRKRK
FeCoV	-----DQV	KVTLT---H	TYLPLKDDAK	TSQFLEQIDA	YKRPS-----	EVAKDQQRKR
PRCoV	-----DQI	EVTFT---H	KYHLPKDDPK	TEQFLQIQNA	YASPS-----	ELAKEQRKRK
CaCoV	-----DQI	EVTFT---H	KYHLPKDDPK	TGQFLQIQNA	YARPS-----	EVAKEQRKRK
RSDACoV	GVEPTKDVY	ELQYSGAVRF	DSTLPGFETI	MKVLNENLNA	YQNOA-----	GGADVSPKP
MHV	GADEPTKDVY	ELQYSGAIRF	DSTLPGFETI	MKVLNENLNA	YQDOA-----	GSVDLVSPKP
PHEV	NPDEPQKDVY	ELRYNGAIRF	DSTLSGFETI	MKVLNENLNA	YQHOE-----	DGMNISPMPK
OC43	NPDEPQKDVY	ELRYNGAIRF	DSTLSGFETI	MKVLNENLNA	YQOO-----	DGMNISPMPK
BoCoV	NPDEPQKDVY	ELRYNGAIRF	DSTLSGFETI	MKVLNENLNA	YQOO-----	DGMNISPMPK
SARS	-----SGT	WLYTHGAIKL	DDKDPQFQDN	VILLNKHIDA	YKTFP-----	PTEPKDKKK
AIBV	-----DGL	HLRFETTVV	PCDDPQFQDN	VYKICDQVDG	VGTRPKDDEP	KPKSRSSSRP

SUBSTITUTE SHEET (RULE 26)

	485	495	505	515	525	535
EMCR	HVAQNTVLN-	-----	-ASIPES---	-KPLADDDSA	IIIEIVNEVLH	-----
229E	SALEFNPSQ-	-----	-TSPATA---	-EPVRDEVSI	ETDIIDEVN-	-----
PEDV	NKRETTLQQH	EEAIYDDVGA	PSDVTHANLE	WDTAVDGGDT	AVEIINEIFD	TGN-----
TGEV	SRSKSAERS-	-----	EQDVVPDALI	ENYTDVFDDT	QVEIIDEVTN	-----
FeCoV	SRSKSADK--	-----	KPEELSVTLV	EAYTDVFDDT	QVEMIDEVTN	-----
PRCoV	SRSKSAERS-	-----	EQEVVPDSLI	ENYTDVFDDT	QVEMIDEVTN	-----
CaCoV	ARSKSVERV-	-----	EQEVVPDALI	ENYTDVFDDT	QVEIIDEVTN	-----
RSDACoV	QRKRGTQKT-	-AQKEELDSI	SVAKPKSAVQ	RNVSRILTPE	DRSLLAQILD	DGVVPDGLDD
MHV	PRRGRRAQ-	-EKKDEVQNV	SVAKPKSLVQ	RNVSRILTPE	DRSLLAQILD	DGVVPDGLDD
PHEV	QRQRGQKN--	--GQVENDNV	SVAAPKSRVQ	QNKSRILTAE	DISLLKKMDE	P-----YTED
OC43	QRQRGHKN--	--GQENDNI	SVAVPKSRVQ	QNKSRILTAE	DISLLKKMDE	P-----YTED
BoCoV	QRQRGQKN--	--GQENDNI	SVAAPKSRVQ	QNKSRILTAE	DISLLKKMDE	P-----YTED
SARS	KTDEAQLP-	-----	QRQKQPTVT	LLPADMDDF	SRQLQNSMSG	ASADSTQA--
AIBV	ATRGNSPAPR	QQRPKKEKKL	KKQDDEADKA	LTSDEERNNA	QLEFYDEPKV	INWGDAALGE
					
EMCR	----					
229E	----					
PEDV	----					
TGEV	----					
FeCoV	----					
PRCoV	----					
CaCoV	----					
RSDACoV	-SNV					
MHV	DSNV					
PHEV	TSEI					
OC43	TSEI					
BoCoV	TSEI					
SARS	----					
AIBV	NEL-					

k. 5'untranslated region (genomic sequence)

	5	15	25	35	45	55
EMCR5'UTR	-----	-----	---AGATAGA	GAATTTTCTT	ATTAGACTT	TGTGTCTACT
229E5'UTR	ACTTAAGTAC	CTTATCTATC	TACAGATAGA	AAAGTTGCTT	-TTTAGACTT	TGTGTCTACT
	65	75	85	95	105	115
EMCR5'UTR	CCTCTCAACT	AAACGAAATT	TTT-CTAGTG	CTGTCAATTG	TTATG--GCA	GTCCTAGTGT
229E5'UTR	TTTCTCAACT	AAACGAAATT	TTTGCTATGG	CCGGCATCTT	TGATGCTGGA	GTCGTAAGTGT
	125	135	145	155	165	175
EMCR5'UTR	AATTGAAATT	TCGTCAAGTT	TGTAA-ACTG	GTTAGGCAAG	TGTTGTATTT	TCTGTGTTTA
229E5'UTR	AATTGAAATT	TCATTGGGGT	TGCAACAGTT	TGGAAGCAAG	TGCTGTGTGT	CCTA-GTCTA
	185	195	205	215	225	235
EMCR5'UTR	AGCACTGGTG	GTTCTGTC-C	ACTAGTGCAC	AC-ATTGATA	CTTAAGT-GG	TGTTCTGTCA
229E5'UTR	AGGGTTTCGT	GTTCCGTGAC	GAGATTCCAT	TCTACAAACG	CCTTACTCGA	GTTCCGTCT
	245	255	265	275	285	
EMCR5'UTR	CTGCTTATTG	TGGAAGCAAC	GTTCTGTCTG	TGTGGAAACC	AATAACTGCT	AACC
229E5'UTR	CGTGTGTTGTG	TGGAAGCAAA	GTTCTGTCTT	TGTGGAAACC	AGTAACTGTT	CCTA

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